CHAPTER 6

EJECTION SEAT SYSTEMS

Terminal Objective: Upon completion of this chapter, you will be able to recognize the components of and maintenance procedures for the removal, installation, and operational test and check of ejection seat systems.

Today's modern high-performance naval aircraft make extreme demands on emergency escape devices. The most critical time for ejection from aircraft is at low altitudes, especially on takeoffs and landings. The ultimate in seat reliability y is one that safely ejects the occupant at zero airspeed and zero altitude or at low altitudes under high sink rate and/or adverse attitude conditions. Today there are a number of different seats in the inventory of naval aircraft. Each of these seats is produced in various models to fit the escape requirements of many aircraft. As aircraft evolve, new needs and criteria dictate changes to seat systems. You will see many of these equipment changes during the time you spend in the Navy.

As examples of ejection seats, this chapter will cover the following three types of seat systems:

Section 1 - ESCAPAC lE1 ejection seat

Section 2 - MARTIN-BAKER SJU-5/A ejection seat

section 3 - STENCEL SJU-8/A ejection seat

ESCAPAC lE - 1 EJECTION SEAT

Learning Objective: Recognize the components, maintenance requirements, emergency survival equipment, and cartridge-actuated devices (CAD) for the ESCAPAC 1E-1 ejection seat.

The lE-1 ESCAPAC ejection seat is a rocket assisted ejection system that provides a quick and safe means of escape from an aircraft. The ESCAPAC seat provides escape capability from ground level at zero-knots airspeed to all altitudes and airspeeds within the operational limits of the aircraft. The ESCAPAC seat has several variations between models. Seat modifications have been incorporated to give the occupant an improved escape and recovery system that assures directional stability during ejection and positive seat-man separation. A manual backup is provided to allow over-the-side bailout as well as emergency egress from the aircraft. In this section we will discuss the ESCAPAC 1E- 1 ejection seat used in the S-3 aircraft.

SYSTEM DESCRIPTION

Following ejection initiation, the lE-1 ESCAPAC system is fully automatic through rocket thrust and burnout, seat-man separation, and parachute opening. The 1E- 1 ejection seat is a very reliable seat system that is initiated by pulling either the primary (face curtain) or secondary (lower) ejection control handle (fig. 6-1). Two cables attached to the primary ejection control handle, or a single cable attached to the secondary ejection control handle, cause the firing control disconnect assembly to pivot forward. Two attached arms move two firing rods aft to actuate the acutating mechanism, which fires the M99 initiator(s) located between the guide rails. Through the aircraft-attached sequencing system, the power inertia reel hauls back the shoulder harness and stows the tactical air coordinator (TACCO) and sensor operator (SENSO) INCOS trays. Simultaneously, hot gas pressure from the M99 initiators(s) activates an

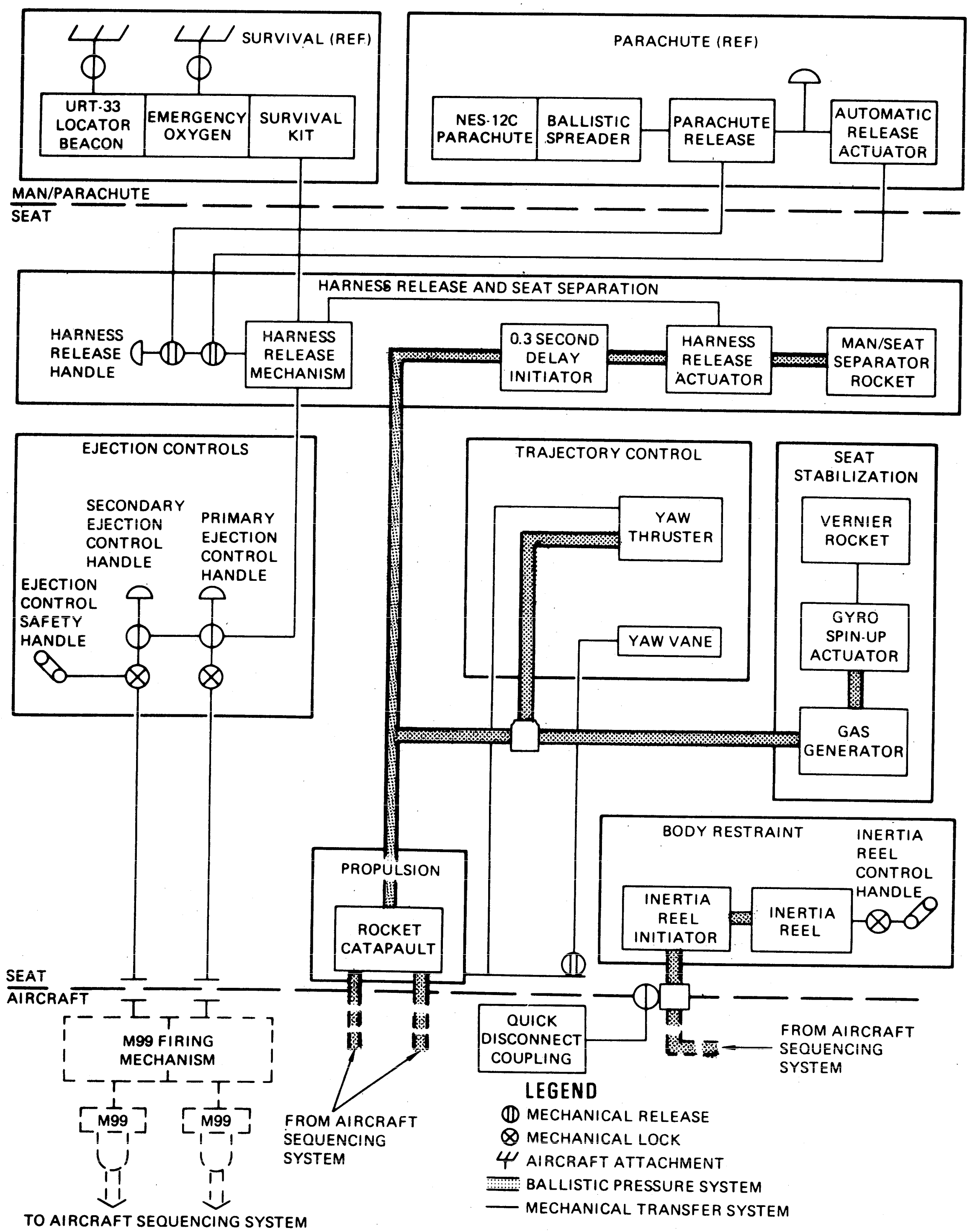


Figure 6-1.—Ejection seat system sequencing schematic.

aircraft-attached 0.3-second delay initiator, which fires the rocket catapult. On the for: ward two seats, an additional 0.5-second delay MK 11 MOD 0 initiator is in series with the 0.3-second delay initiator to delay forward seat ejection sequencing by 0.5 second after the rear seats eject. The eject mode selector handles on the pilot's and copilot's seat provide pilot or copilot control of individual or group ejection of crew members.

The first-phase propulsion of the rocket catapult starts the seat up in the guide rails. When the seat has moved approximately two-thirds the length of the guide rails, the second (or sustainer) phase of the rocket catapult ignites to provide boost for the additional height required during ejection. At sustainer separation, gas pressure from rocket ignition is used to ignite the seat stabilization control system, the yaw thruster, and the seat-attached 0.3-second delay initiator for harness release. Before the seat clears the guide rails, the following five functions occur: crew member services to the aircraft is disconnected; the parachute arming lanyard is pulled, which arms the parachute release actuator; the lanyard connected to the aircraft structure actuates the emergency oxygen bottle in the survival kit to supply the crew member with emergency bailout oxygen; the yaw vane is deployed, and the quick-disconnect coupling on the right side of the seat separates.

Following burnout of the yaw thruster rocket and sustainer rocket, and upon the completion of the pitch stabilization control function, the seat-attached 0.3-second delay initiator fires. Gas pressure from the initiator enters the harness release actuator, which drives the piston upward to rotate the bell crank mounted below the actuator to retract two survival kit retaining pins and shoulder harness pin from two inertia reel straps. Retraction of retaining pins frees the crew member and his survival equipment from the seat. The base of the clevis on the lower end of the actuator piston strikes the firing control disconnect actuating arm. Movement of the arm retracts a spring-loaded retaining pin from the firing control disconnect assembly, and releases the ejection control handle cables from the assembly. A crew member, who may still be holding one of the ejection control handles, is now freed from any restraints that would prevent the final separation from the seat. As the harness release actuator piston completes the stroke, the pressure within the actuator is ported to the man/seat separator rocket, causing the rocket to ignite.

The thrust of the man/seat separator rocket simultaneously rotates and propels the seat away from the crew member with a differential velocity of up to 25 to 30 feet per second. The probability of collison between the seat and a crew member or the parachute after separation is minimized, because no attempt is made to decelerate the seat as the seat travels along a divergent trajectory. As the seat and crew member move into divergent paths, the parachute actuator is armed and the external pilot chute is deployed. After a 0.55-second delay, the main parachute is aerodynamically deployed. Just before the parachute shroud lines stretch, the ballistic spreading gun is fired to forcefully initiate parachute inflation.

If a crew member is above an altitude of 14,000 (± 500) feet, a preset aneroid in the parachute actuator delays parachute deployment until the crew member has descended to the correct altitude. The parachute actuator delay cartridge then fires, causing parachute deployment. The crew member can select parachute deployment at any altitude by pulling the manual ripcord on the parachute.

If the automatic ejection system malfunctions, the crew member can pull the internal jettison handle/initiator(s) in the crew compartment to cut the window/hatches away. Over-the-side bailout is initiated by pulling the harness release mechanism, which disconnects the rigid survival kit and the parachute from the seat structure. The crew member can then stand up and exit the crew compartment. When clear of the aircraft, the crew member pulls the parachute manual ripcord located on the left riser strap immediately above the parachute canopy release fitting. The parachute flaps are thereby released, and the parachute deploys.

COMPONENTS

Figure 6-2 shows the front and rear views of the ESCAPAC 1E-1 ejection seat assembly and its various components.

Ejection Seat

The ejection seat is the basic structure that supports the equipment and mechanisms necessary for crew member comfort and safety while in flight or during the ejection sequence. The seat and associated components are constructed almost entirely of aluminum. The seat is equipped with fixed window/hatch breakers at each top forward corner to permit seat ejection through a 1/4-inch stretched acrylic window or hatch. At the upper center of the seat are headrest cushions that provide cushioning for the safety and comfort of the crew member. On each side of the seat are three seat rollers, which allow for vertical height adjustment during normal conditions and upward travel during ejection. Extended seat bucket sides protect the crew member's knees and legs from flailing during seat ejection. The seat structure supports the parachute assembly and survival kit.

PRIMARY EJECTION CONTROL HAN**DLE.—** The primary ejection control handle (face curtain) gives each crew member the means to manually initiate automatic seat ejection. The primary handle, which is an integral part of the nylon screen assembly, is connected through cables to the firing control disconnect assembly. The pivoted firing control disconnect provides a mechanical interlock between the primary and secondary ejection control handles.

SECONDARY EJECTION CONTROL HANDLE.— The secondary ejection control handle is located on the front frame of the seat structure. A cable connects the handle to a disconnect pulley assembly under the seat bucket. A second cable connects the disconnect pulley assembly to the firing control disconnect assembly at the top of the seat.

EJECTION CONTROL SAFETY HANDLE.— To prevent accidental seat ejection, a safety handle (head knocker), when placed in the down-and-locked position, prevents inadvertent actuation of all component parts of the firing control mechanism. The safety handle is identified by a yellow and black decal that reads PULL OUT TO SAFETY EJECTION CONTROLS. A safety lock, incorporated in the safety handle, automatically locks the handle in the full-out position; the lock must be manually depressed before the safety handle can be moved to the up (recessed) position.

POWER INERTIA REEL INITIATOR.— The inertia reel initiator is located on the rear left side of the seat, below and to the left of the inertia reel. The inertia reel initiator powers the inertia reel for automatic power retraction of the shoulder harness during the seat ejection sequence. The initiator gases discharge into a tubing segment that is filled with high-vacuum grease, and then into the inertia reel.

POWER INERTIA REEL.— The inertia reel is centrally located in the upper part of the seat behind the headrest cushions. In the seat ejection sequence, the inertia reel provides automatic power retraction of the shoulder harness in preparation for seat ejection. The inertia reel facilitates voluntary forward movement of the crew member, and functions as a self-compensating restraint against involuntary forward movement resulting from excessive g-forces or other aircraft stresses. An inertia reel control handle on the left arm of the seat can be manually unlocked or locked to allow or prevent extension of shoulder harness straps. Two prestretched Dacron straps are part of the inertia reel. A flexible inertia reel cable couples the inertia reel to the inertia reel control handle.

GYRO SPIN-UP GAS GENERATOR CARTRIDGE.— The gas generator is attached to the pitch stabilization control (STAPAC), which is located under the seat bucket. The gas generator powers the gyro spin-up actuator, and subsequently powers the sear cam piston. The gas generator is a percussion-ignited device that is fired by ballistic gas pressure ported from the rocket catapult when the rocket portion fires.

VERNIER ROCKET.— The vernier rocket is a mechanically fired rocket motor located across and under the seat bucket; the vernier rocket is part of the pitch stabilization control unit. The gas generator powers the sear cam piston to fire the vernier rocket, whose rotation is controlled by the pitch rate gyro.

PITCH STABILIZATION CONTROL (STAPAC).— A unique but simple STAPAC stabilizes the seat during conditions of large center of gravity (cg) main rocket thrust misalignment, and high aerodynamically induced pitch torque. The STAPAC, located under the seat bucket, operates from the time the seat leaves the guide rails until after rocket sustainer burnout. The STAPAC consists of a mechanically fired vernier

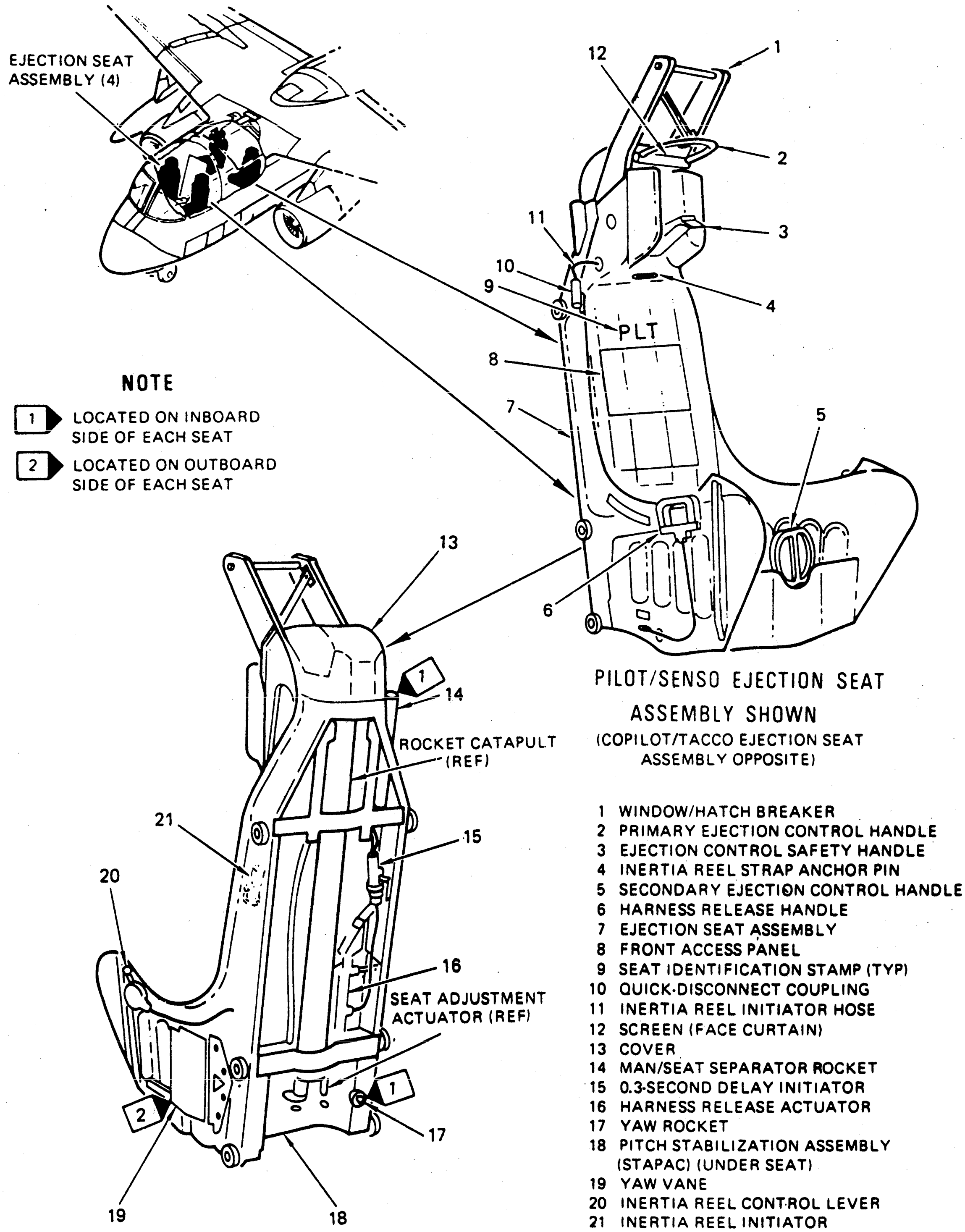


Figure 6-2.—Ejection seat assembly.

rocket, a gyro spin-up gas generator cartridge, and a simple pitch rate gyro located forward of the vernier rocket. The gyro comes up to operating speed by the gas generator-driven gear rack as the gyro is uncaged and the vernier rocket fires. The vernier rocket burns during rocket sustainer stage burning for approximately 0.3 second. Mounting of the vernier rocket in the caged position allows the nozzle thrust vector to be directed up through the nominal cg of the occupied seat. If the seat starts to pitch because of adverse torque of any origin, the gyro precesses and rotates the vernier rocket around the pitch axis, which changes the thrust/cg relationship and applies a correcting moment.

YAW THRUSTER.— To achieve safe separation of multicrew seat trajectories, a yaw thruster is used on each seat to provide a controlled, lateral-angle dispersion from the aircraft's direction of flight. Two types of yaw thrusters are used on the forward and aft seats, with location always on the inboard side of each seat. A low yaw thruster, producing approximately a 10.4 pound-second impulse for 0.1 second, is installed on each forward seat, and a high yaw thruster, producing approximately a 21.0 pound-second impulse for 0.1 second, is installed on each aft seat. The yaw thruster is ignited by high-pressure gas ported from the top of the rocket catapult.

To provide proper yaw rotational impulse for each seat installation, the yaw thruster is mounted to provide a predetermined moment arm about the center of gravity of the seat/crew member system. The mounting bracket for each thruster incorporates a boss that, when combined with a fixed stop permanently mounted on each guide rail, will prevent incorrect installation. The right and left seats are yawed to produce changes in the trajectory paths. Each of the four crew member seats will be separated from the others at parachute full-open condition under nominal lateral center-of-gravity conditions.

YAW VANE.— To assist in providing the proper yaw rotation at higher airspeeds, an aerodynamic yaw vane is installed on the outboard, lower aft side of each seat. The yaw vane deploys just as the seat leaves the guide rails and presents a drag area of 1/2 square foot to yaw the seat approximately 20 degrees. At this position, the vane is blanked by the man/seat structure, and becomes ineffective in creating any further increase in the degree of rotation.

Harness Release and Seat Separation

The harness release system provides automatic release of the shoulder harness and lap belts during the ejection sequence. The survival kit and shoulder harness are locked in the seat by three retaining pins, two through the survival kit lugs and one through the shoulder harness inertia reel strap lugs. Automatic release from the seat during the ejection sequence is accomplished by the harness release actuator, using a pressure-actuated 0.3-second delay initiator. Gas pressure, which exits from the outlet port of the harness release actuator, is used to actuate the man/seat separator rocket in the seat separation subsystem.

PRESSURE-ACTUATED 0.3-SECOND DELAY INITIATOR.— The 0.3-second initiator is located on the rear right side of the seat above the harness release actuator. The 0.3-second initiator is a pressure-actuated device with a conventional firing piston secured in the cocked position by a shear pin. Gas pressure from the rocket catapult actuates the initiator, which fires into the inlet port of the harness release actuator.

HARNESS RELEASE ACTUATOR.— The actuator is mounted on the rear right side of the seat. The actuator contains a piston and rod that are actuated by a 0.3-second delay initiator firing into the inlet port. Gas pressure exits from the outlet port to actuate the man/seat separator rocket. The piston rod, which extends below the actuator, is connected to the harness release bell crank. The bell crank initiates simultaneous automatic actuation of each component of the harness release system to cause man/seat separation during seat ejection. If the lap belts and shoulder harness assemblies fail to release automatically, the crew member can actuate the harness release handle to release the assemblies. The handle is also useful for routine removal and installation of the parachute and survival kit. The following components are connected to the multiple arm bell crank: harness release actuator piston rod, survival kit retaining pins, inertia reel straps retaining pin cable, harness release handle cable, and bell crank return spring. The actuator also actuates the firing control disconnect actuating arm.

MAN/SEAT SEPARATOR ROCKET.— The separator rocket is mounted on the aft inboard side of the headrest area of each seat. The separator rocket is used to separate the crew member from the seat and drive the seat into a divergent trajectory. Pressure from the harness release actuator outlet port is used to initiate the separator rocket. The separator rocket nozzle is oriented to direct the exhaust plume forward, up, and away from the crew member.

Aircraft-Attached Ejection Seat Components

The following ejection seat related components are located on the aircraft structure and remain in the aircraft when the seat is removed for maintenance.

GUIDE RAILS.— Two guide rails are located on each canted bulkhead behind each crew member. Each **set** of guide rails is machined from aluminum extrusions. Each outboard rail has a machined cam at the top to release the aerodynamic yaw vane as the seat travels up the guide rails. Two holes in each inboard guide rail allow installation of two seat servicing pins to support each seat at the 42-inch alternate maintenance position.

SEAT CONTROL SYSTEM.— The seat control system permits vertical height adjustment of each crew member's seat before and during' normal flight. Phase reversal of two phases of a three-phase power source permits raising or lowering each seat according to the selected UP or DOWN position of the switch on the SEAT panel on the side console at each crew member station (fig. 6-3). The seat control system consists of a seat switch and a seat adjustment actuator and motor. Seat adjustment is provided by a

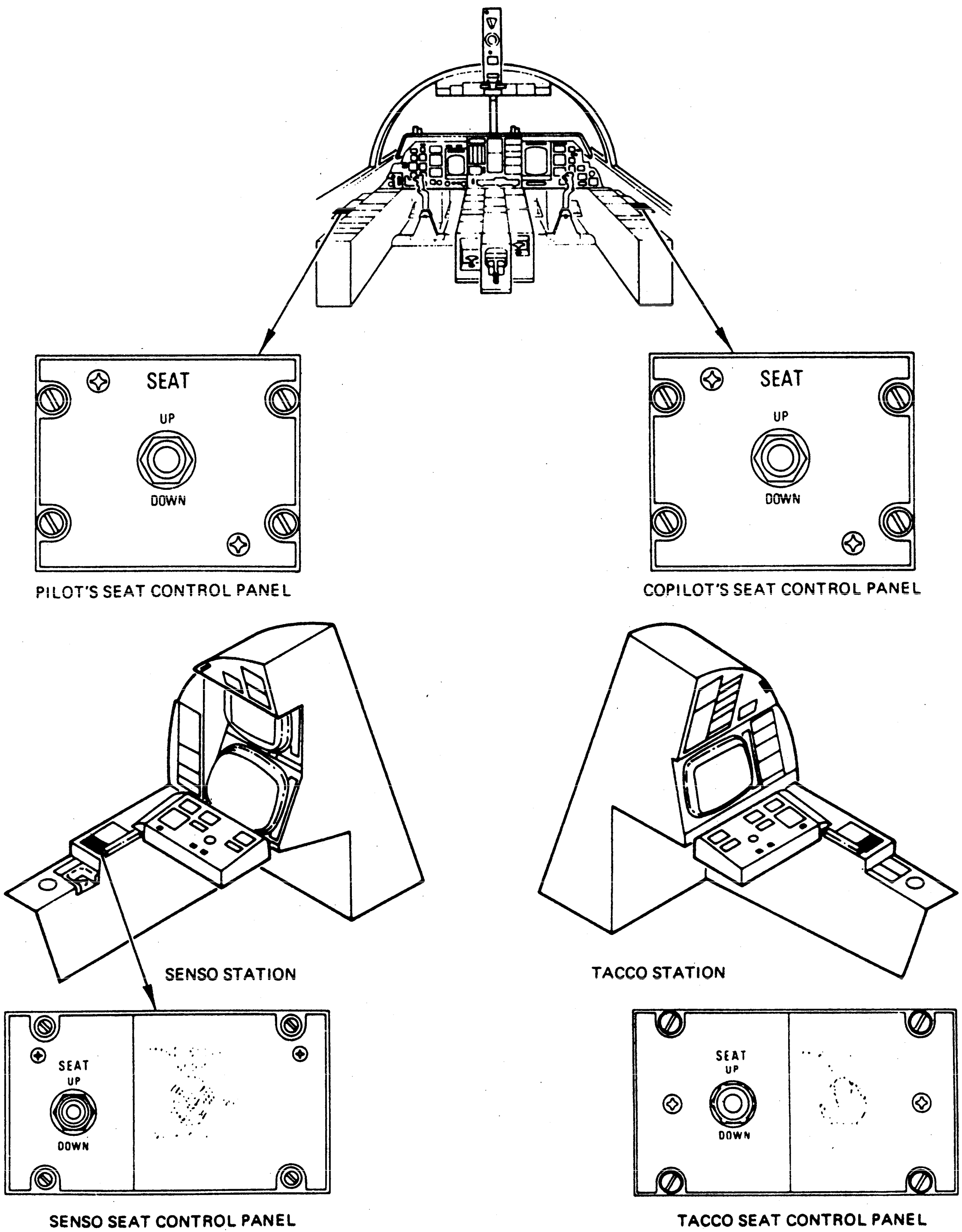


Figure 6-3.—Seat control panel and seat switch.

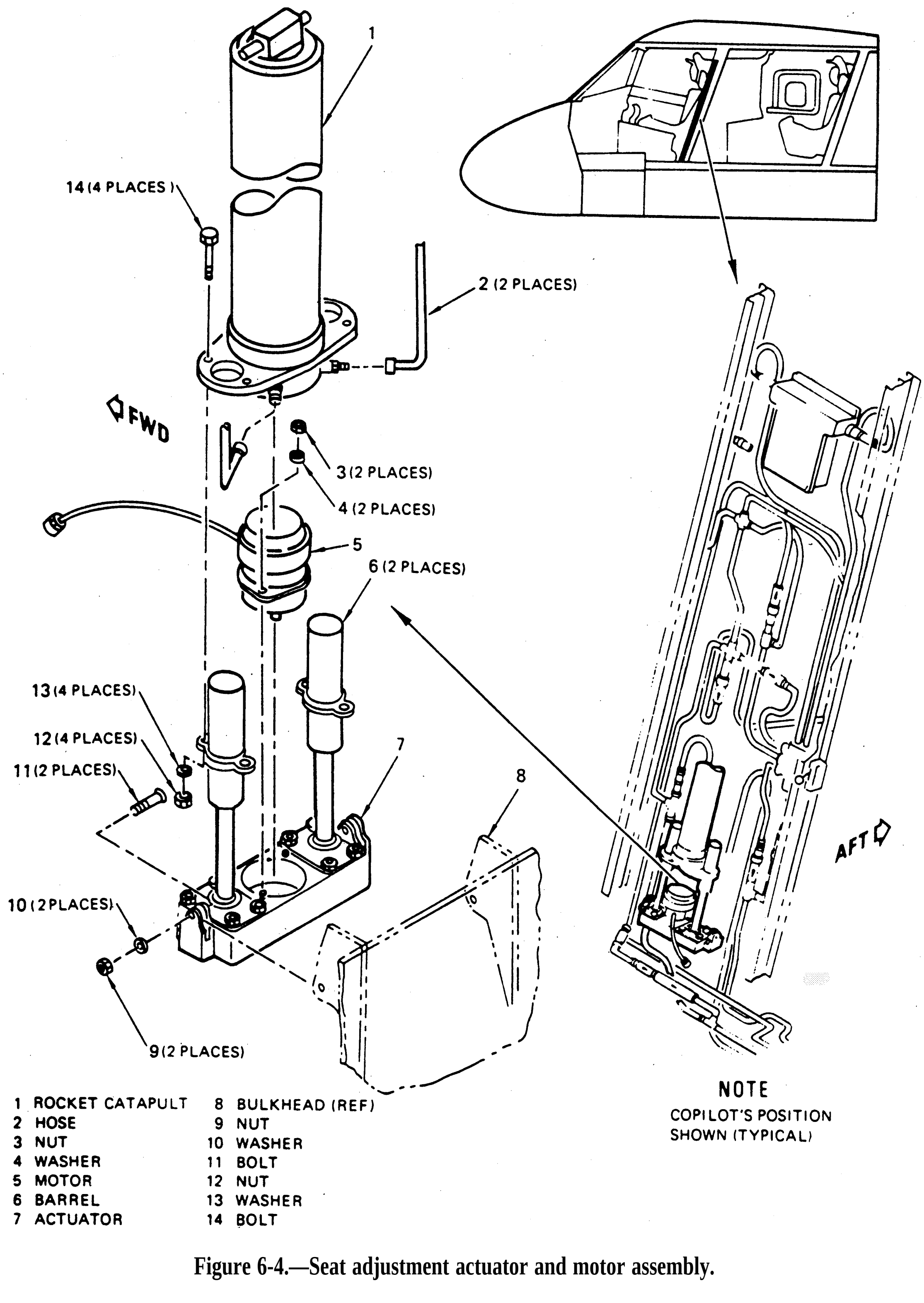


Figure 6-4.—Seat adjustment actuator and motor assembly.

twin-barrel electromechanical actuator (fig. 6-4), which is driven by a 115/200-volt, 400-Hz, three-phase, four-pole induction motor. The motor is geared to a reduction gear train, which drives two screw barrels that are attached to mating flanges on the base of the rocket catapult. The rocket catapult is bolted to the top of the seat structure, which allows a 5.5-inch up and down adjustment of the seat parallel to the guide rails. Six rollers on the seat allow the seat to move up or down the guide rails.

ROCKET CATAPULT.— The rocket catapult provides the necessary propulsion to eject the seat and crew member from the aircraft during the ejection sequence. The performance capability of the rocket catapult at zero altitude and zero airspeed reduces the effects of high sink rate and nosedown attitudes encountered during critical approach and landing operations. The rocket catapult is secured at the top center of the seat back, and is supported at the base by twin barrels of the seat adjustment actuator. Two attachments on the actuator secure the actuator to the aircraft bulkhead.

M99 INITIATORS.— Two M99 initiators are installed on the M99 initiator actuating mechanism (fig. 6-5) near the top of each canted bulkhead behind the pilot's and copilot's seats, and one M99 initiator is installed at each tactical air coordinator (TACCO) and sensor operator (SENSO) seat location. The M99 initiator is a mechanically fired, pressure-developing source. Each M99 initiator, consisting of a constant-volume cylinder with a tube connection at one end, contains a mechanically fired mechanism and cartridge. The M99 initiator firing mechanism can be secured in a safe position by a safety pin that passes through the cap and a groove on the side of the M99 initiator pin. Pulling either the primary or secondary ejection control handle initiates the ejection sequence, which, in turn, rotates the firing control disconnect, moves two firing rods

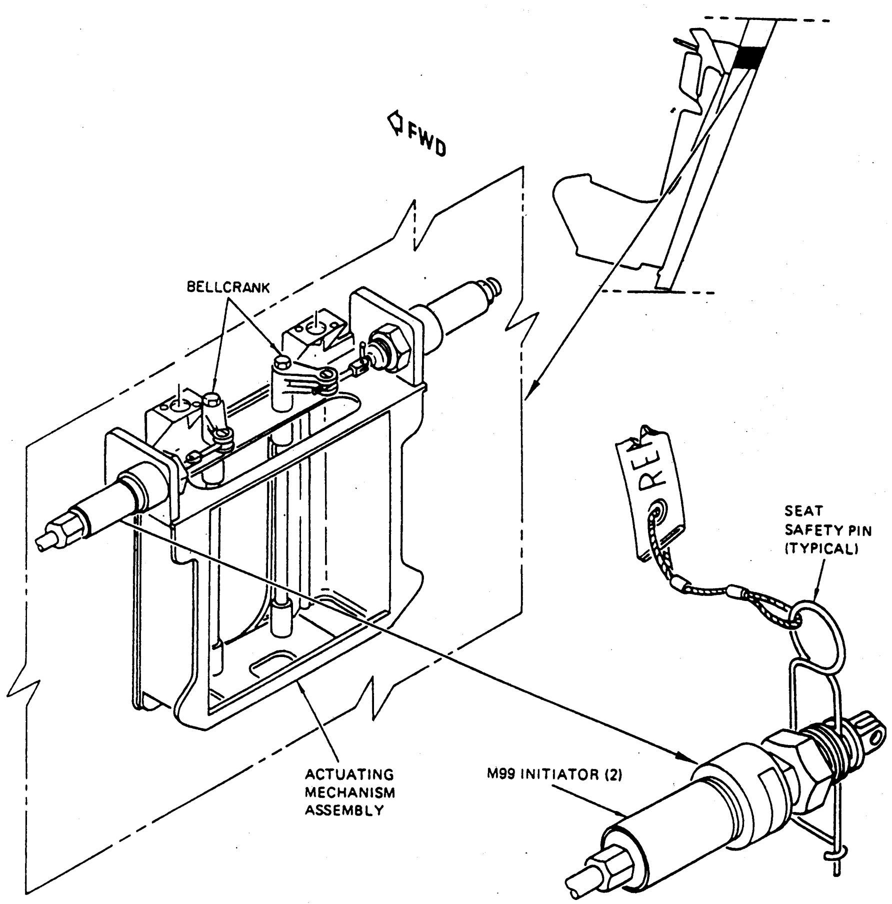


Figure 6-5.—M99 initiator location.

aft to rotate the actuating mechanism bell crank(s) that fires the initiator(s).

M99 INITIATOR ACTUATING MECHANISM.— The actuating mechanism is located between the guide rails, and is attached to the upper section of each canted bulkhead, behind each crew member's seat. The actuating mechanism for the forward seats have dual bell cranks (striker plates) and clevises to actuate the two M99 initiators installed on each side of the actuating mechanism. Since each aft seat requires one M99 initiator for the ejection sequence, the actuating mechanism is a single bell crank and clevis arrangement. During the seat ejection sequence, the seat-mounted firing rods are moved aft to rotate the actuating mechanism bell crank(s) and clevis(es) to fire the M99 initiator(s).

Refer to figure 6-6 while reading the following text.

M53 INITIATOR.— There are thirteen M53 initiators installed in aircraft-attached ejection seat plumbing. Eleven of the M53 initiators are installed between the guide rails, and two initiators are installed at flight station (FS) 263 (one each at the INCOS tray thruster location). Each pilot and copilot location has four M53 initiators; the TACCO location has one; and the SENSO station has two. The M53 initiator is a cartridge-actuated, gas-producing device triggered by gas pressure from a remote source. The M53 initiator consists of a constant-volume cylinder with a tube connection at one end and a gas-operated firing mechanism and cartridge. In the ejection seat sequence, gas pressure from the M99 initiator(s) actuates the M53 initiators. M53 initiators characteristically serve as line-boosters in the ejection seat system to counteract rapid pressure decay caused by tubing length.

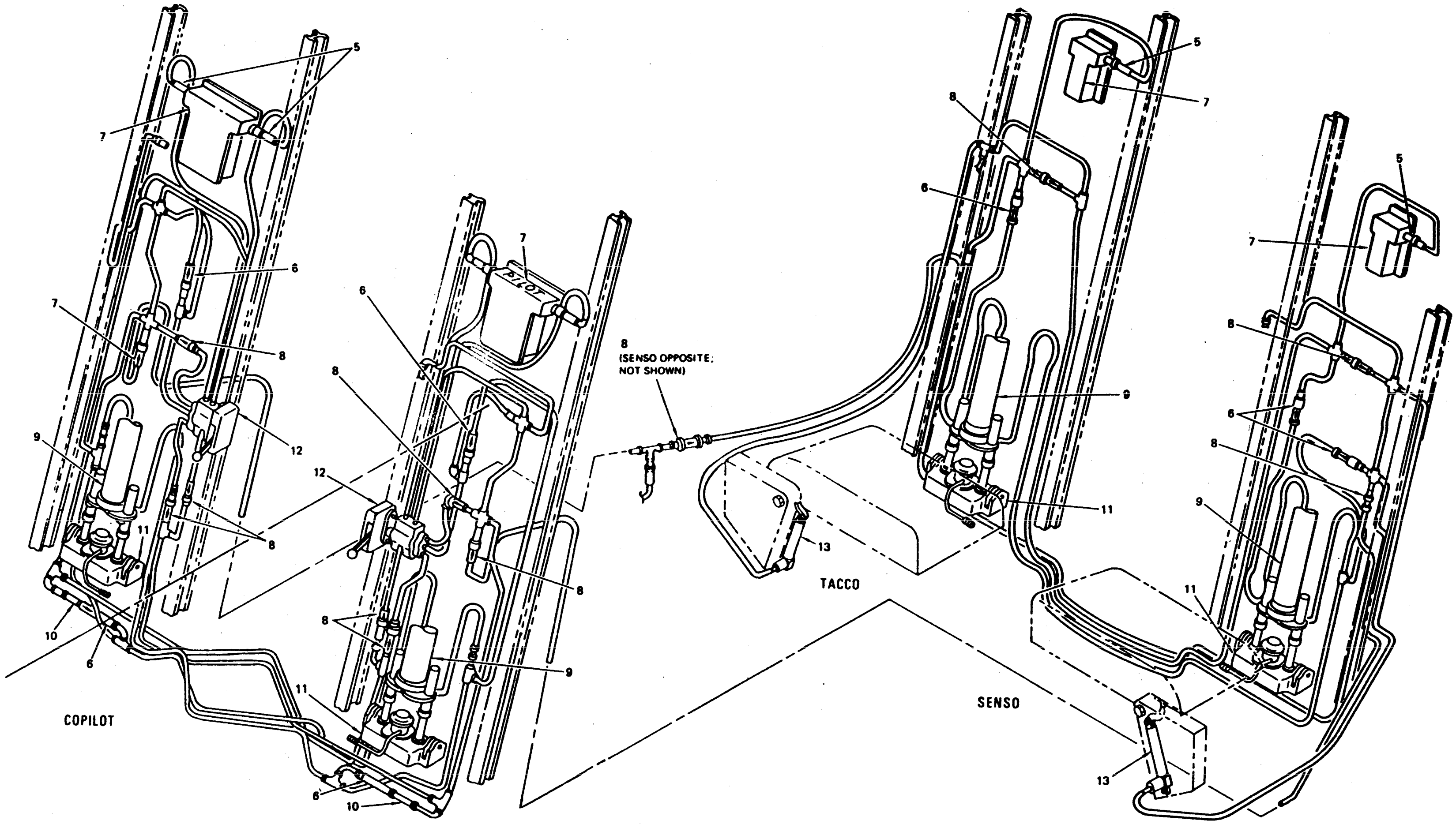
PRESSURE-ACTUATED 0.3-SECOND DELAY INITIATOR.— Seven 0.3-second delay initiators are installed between the guide rails. Two 0.3-second delay initiators are installed at the pilot's, the copilot's, and the SENSO station; and one is installed at the TACCO station. At the pilot's and copilot's stations, an Mk 11 MOD 0 initiator is installed on the 0.3-second delay initiator. The 0.3-second delay initiator is a pressure-actuated device with a conventional firing piston secured in the cocked position by a shear pin. In the ejection sequence, the 0.3-second delay initiators are used as time delays in the inertia reel shoulder harness retraction, in the INCOS trays retraction, and in the group or solo ejection sequencing of crew members in the firing of the rocket catapult(s).

MK 11 MOD 0 INITIATOR.— A MK 11 MOD 0 initiator is installed below the floor line directly under the rocket catapult at the pilot and copilot seat locations. Each MK 11 MOD 0 initiator is installed on the 0.3-second delay initiator, and both fire into the rocket catapult. The MK 11 MOD 0 initiator is a cartridge-actuated device triggered by gas pressure from a remote source. In the ejection sequence, the MK 11 MOD 0 initiators are used as time delays in the group-ejection (all seats) mode to allow the two aft seats to eject 0.5 second before the front seats to permit proper spacing of personnel for safe parachute deployment and landing.

PLUMBING AND CHECK VALVES.— Most plumbing for the aircraft-attached ejection seat components is flexible hose-type plumbing located between the guide rails. There are a minimum of lines between the forward and aft seats and the INCOS tray thrusters. There are twenty check valves installed in aircraft-attached ejection seat components; all are located between the guide rails. In the ejection sequence, the check valves allow the correct group or solo-ejection selection to occur.

INCOS TRAY THRUSTER.— At both the TACCO and SENSO locations, a thruster is installed to retract the respective INCOS trays during the seat ejection sequence. The thruster is a pressure/percussion device that employs sear pins, firing pins, and primers to ignite the main charge. In the ejection sequence, the INCOS tray is retracted at the same time that the inertia reel shoulder harness retraction occurs.

EJECT MODE SELECTOR VALVE.— A selector valve is installed on each inboard guide rail in the flight station. The selector valve consists of a beam assembly with a switch and handle and the valve body. The selector valve routes high-pressure gas from the M99 initiators to the aircraft sequencing system, depending on the selected position (GROUP EJECT or SELF EJECT) of the selector valve. When the pilot's or copilot's selector valve handle is in the down or GROUP EJECT position, an electrical ground is completed, which causes the GROUP EJECT indicators to come on at the SENSO and TACCO instrument panels. When either selector valve handle is in the up or SELF EJECT position and the aircraft altitude is less than 15,000 feet, the altitude sensor switch cause the indicator



1 THROUGH 4 NOT SHOWN
ON THIS PART
5 M99 INITIATOR
6 PRESSURER-ACTUATED 0.3- SECOND
DELAY INITIATOR
7 ACTUATING MECHANISM
8 M53 INITIATOR
9 ROCKET CATAPULT
10 MK11 MOD 0 INITIATOR
11 SEAT ADJUSTMENT ACTUATOR
12 EJECT MODE SELECTOR VALVE
13 NOT SHOWN ON THIS PART

1 THROUGH 4, 10, AND 12 NOT
SHOWN ON THIS PART
5 M99 INITIATOR
6 PRESSURE-ACTUATED 0.3-SECOND
DELAY INITIATOR
7 ACTUATING MECHANISM
8 M53 INITIATOR
9 ROCKET CATAPULT
11 SEAT ADJUSTMENT ACTUATOR
13 INCOS TRAY THRUSTER

Figure 6-6.Aircraft mounted CAD's.

on the annunicator panel (located on the center instrument panel) to come on.

ALTITUDE SENSOR SWITCH.— An altitude sensor switch is located on the forward bulkhead of the camera compartment. The sensor switch monitors the aircraft altitude. When the eject mode selector valve handle is in the up or SELF-EJECT position and the aircraft altitude is less than 15,000 feet, the sensor switch causes the seat select indicator on the annunciator panel (located on the center instrument panel) to come on. When the aircraft altitude reaches or exceeds 15,000 feet, the seat select indicator goes off.

GROUP EJECT INDICATORS.— A group eject indicator is installed on the SENSO and TACCO instrument panels. When the pilot's or copilot's selector valve handle is in the down or GROUP EJECT position, a switch in the selector valve completes an electrical ground, and causes both group eject indicators to come on. When both selector valve handles are in the up or SELF EJECT position, the group eject indicators go off.

EJECTION WARNING SYSTEM.— The ejection warning system is used to warn the TACCO and SENSO that an emergency is occurring, and that seat ejection is about to be initiated. The system uses an eject switch on the eyebrow panel, an emergency power unit, a flasher, and eject indicators on the TACCO and SENSO instrument panels. The pilot or copilot sets the eject switch to EJECT, which turns on flashing eject indicators on the TACCO and SENSO instrument panels.

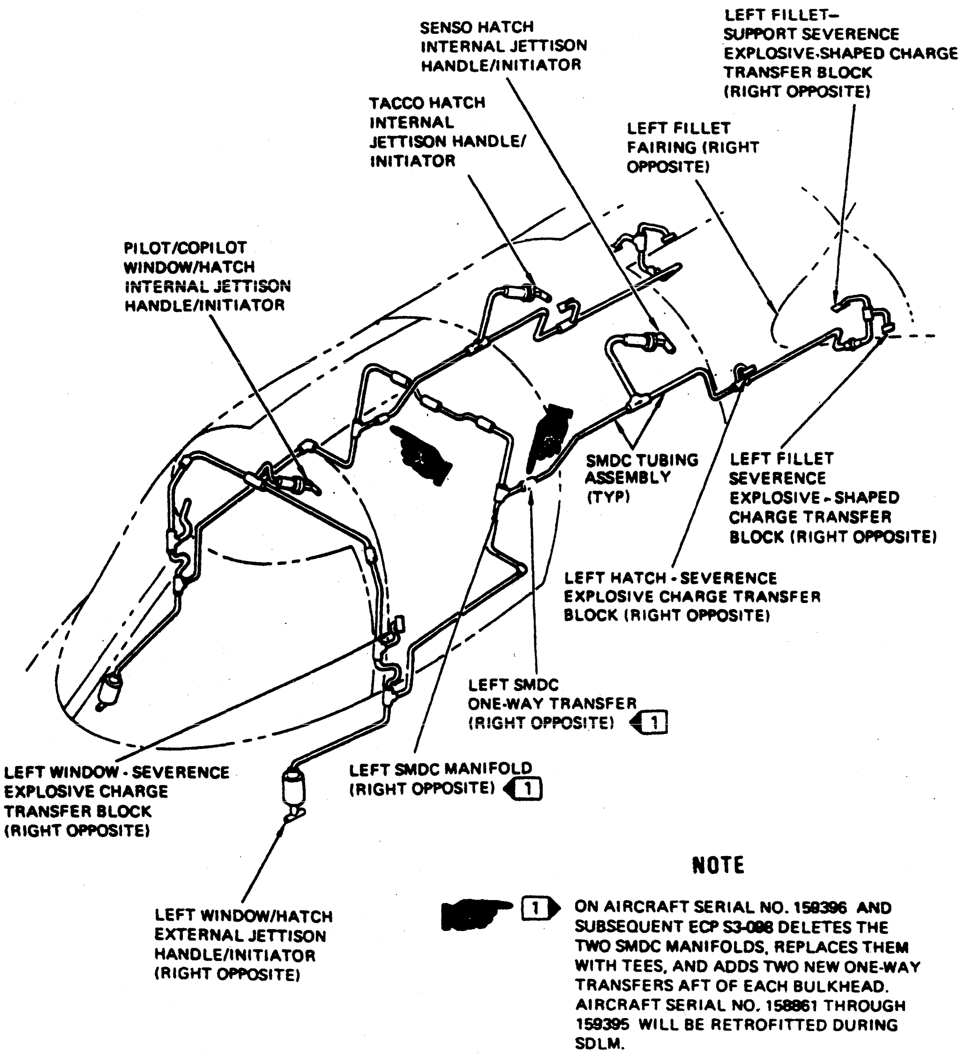


Figure 6-7.—Emergency egress system components and plumbing.

Window/Hatch Severance System

The emergency egress system provides a means of escape from the aircraft for crew members after ditching or after a wheels-up landing by initiation of explosive charges to blow out windows and hatches. The S-3 emergency egress system is distinguished from hot gas and actuator systems by its use of shielded mild-detonating cord (SMDC) instead of hot gas and explosive charges instead of actuators. The S-3 system is much less susceptible to inadvertent actuation than hot gas systems, and more convenient and safer for maintenance personnel.

The S-3 emergency egress system (fig. 6-7) consists of two window-hatch external jettison handle/initiators, three window/hatch internal jettison handle/initiators, window and hatch-severance explosive charges, fillet-severance and fillet-support severance explosive-shaped charges, SMDC's, and SMDC manifolds or one-way transfers.

FUNCTIONAL DESCRIPTION.— The S-3 emergency egress system is initiated from any one of five positions—two on the outside of the flight station, and three located in the crew compartment at the eyebrow panel and at the TACCO and SENSO instrument panels. All windows and hatches are cut and blown outward by the actuation of either exterior window/hatch external jettison handle/initiator, and by the pilot's,/copilot's interior window/hatch internal jettison handle/initiator. The TACCO and SENSO window/hatch internal jettison handle/initiators cut only the respective panel next to the crew member, The system is used primarily for ground and water rescues. The handle/initiators have a trigger action. Once the system is actuated, the system will respond to completion without further action by crew members. The functional sequence is from the handle/initiator (any one) to the SMDC, to the explosive charge, which is the actual cutting tool for the window or hatch glass. If either or both the TACCO and SENSO hatches are to be blown, the respective fillet and fillet support will be cut to allow complete egress of the hatch. When either the TACCO or SENSO crew member actuates the handle/iniator, the opposite hatch and the two flight station windows will not be cut, since an SMDC manifold (check tee) or one-way transfer restricts transfer of pyrotechnic energy flow to one direction.

The emergency egress system is entirely self-sufficient and completely independent. The system does not depend on any other aircraft system, nor does the system aid, assist, or sequence with another system. The SMDC system is more reliable and much faster than a comparable hot gas system. The system is safer from the standpoint of inadvertent actuation due to the extremely high initiating velocities and pressures. The high operating velocity is much too fast to permit system initiation by ordinary sawing, filing, drilling, or hammering. With quick-release safety pins properly installed, the system is virtually inert.

COMPONENTS.— The following items are components of the window/hatch severance system.

Window/Hatch External Jettison Handle/Initiator.— Two external jettison initiators are installed inside access doors on each exterior side of the aircraft just below and forward of the windshield aft posts, The external cartridge-activated initiator (fig. 6-8) is a mechanically fired device,

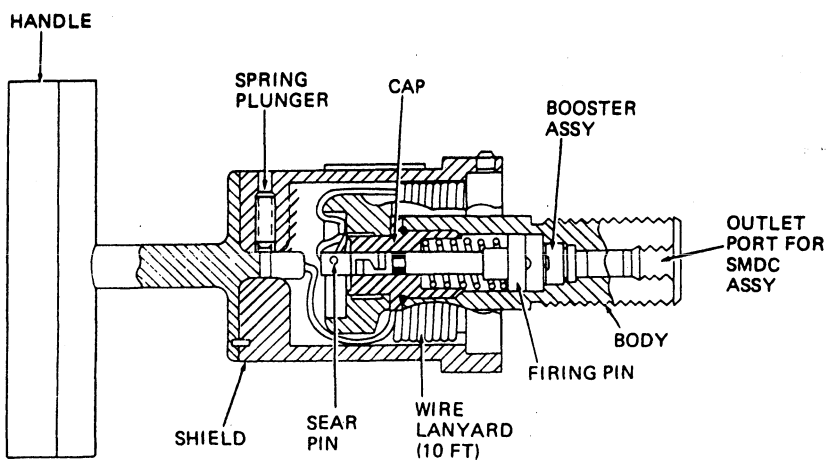


Figure 6-8.—External cartridge-actuated initiator.

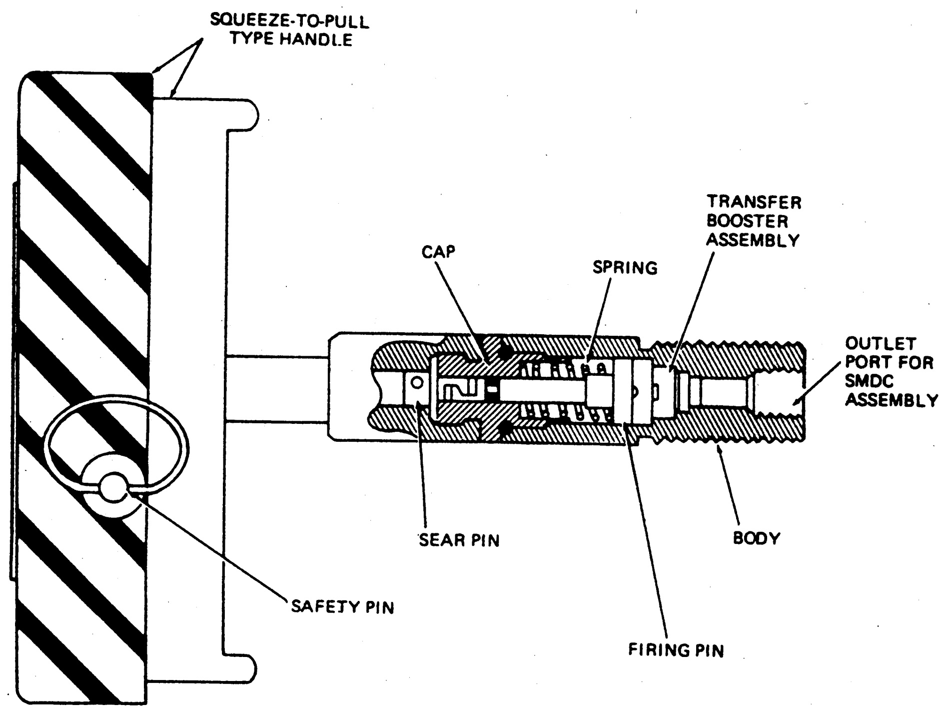


Figure 6-9.—Internal canopy/hatch severance initiator.

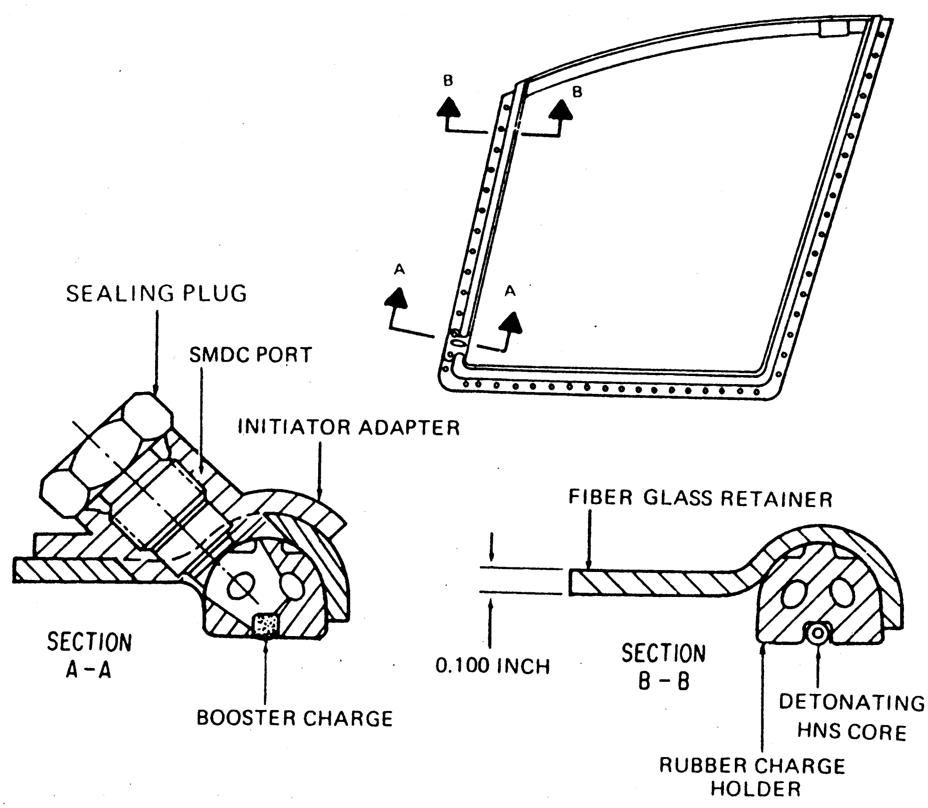


Figure6-10.—Pilot/NFO window-severance linear shaped charge.

with the firing pin relaxed (not precocked) before handle actuation. The sear mechanism is a conventional ball-and-node type, which disengages completely after 3/4-inch of travel. During travel, the firing pin withdraws, but the handle does not disengage. The primer fires into a lead azide charge, which fires the output charge. The external jettison initiators have no safety pins, but use a 10-foot lanyard to protect against inadvertent initiation. Either external initiator will cause all windows, hatches, fillets, and fillet supports to blow away from the aircraft.

Window/Hatch Internal Jettison Handle/ Initiator.— Three window/hatch internal jettison handle/initiators (internal jettison initiators) are located in the crew compartment: one at the eyebrow panel and one each at the TACCO and SENSO instrument panels. The internal canopy/ hatch severance initiators (fig. 6-9) are the squeeze-to-pull type, which have a quick-release safety pin in the squeeze segment of the operation for safetying. The pilot's/copilot's handle will blow all windows and hatches, whereas the TACCO and SENSO handles will blow only the hatch above the crew member. The basic internal jettison handle initiators are similar to the external jettison handle initiators except for the handle and the absence of the lanyard feature.

Pilot/NFO Window Severance Linear Shaped Charge.— A window severance explosive charge (fig. 6-10) is attached to the inside periphery of the pilot's and copilot's windows. An SMDC connects to a transfer block at the lower front corner of the explosive charge. The window explosive charge is actuated by the pilot's/ copilot's internal jettison handle/initiator or by either external jettison handle/initiators through the SMDC segments. The explosive charge acts as the cutting device for the window glass.

Hatch Severance Explosive Charge.— The hatch severance explosive charge is similar to the window severance explosive charge. The explosive charges of the hatches can be actuated by the external jettison handle/initiators or by the pilot's/copilot's handle/initiator. The TACCO or SENSO hatch explosive charge can be actuated individually by the respective TACCO or SENSO handle/initiator.

Fillet and Fillet Support Explosive Shaped Charge.— Each right and left upper wing-to-fuselage fillet has a fillet-severance, explosive shaped charge attached near the outer and rear fillet attachments (fig. 6-11). The shape charge cuts the attached fillet from the aircraft to allow complete egress of the respective hatch. A fillet

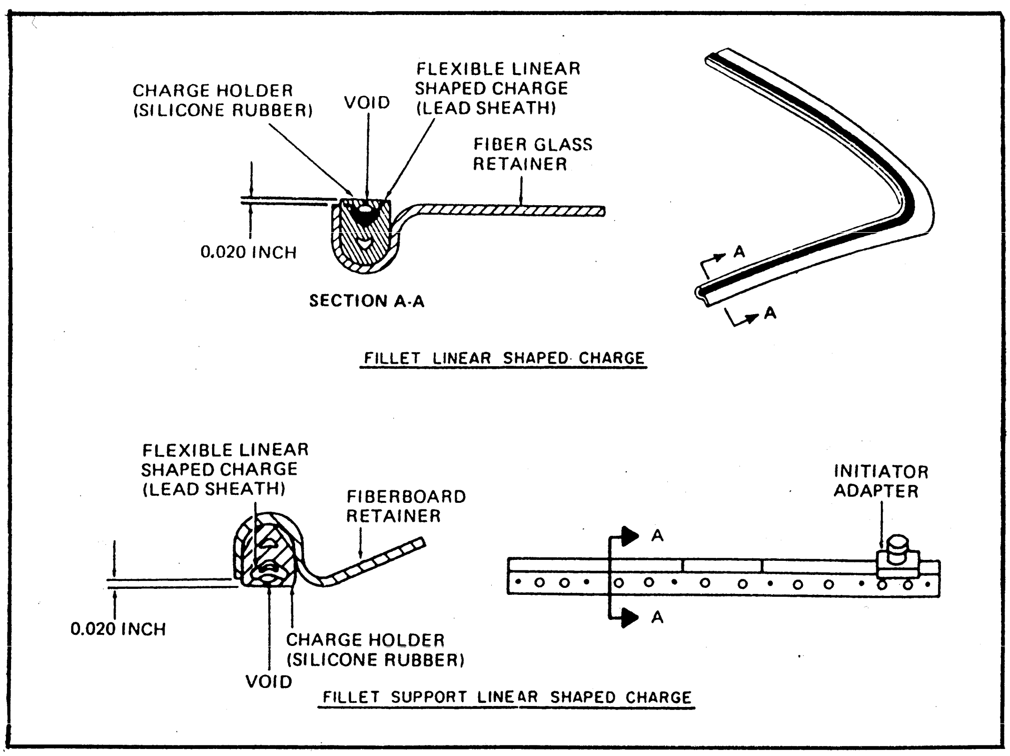


Figure 6-11.—Fillet and fillet support explosive shaped charge.

support is cut by a second shaped charge attached at the bottom.

Fillet Support Severance Explosive Shaped Charge.— A shaped charge is attached at the bottom of the internal fillet support to cut the support to allow the-fillet to separate from the aircraft during the emergency egress system operation (fig. 6-11).

Shielded Mild Detonating Cord (SMDC).— The 31 SMDC segments (fig. 6-12) act as the plumbing for the emergency egress system. The SMDC connects all external and internal jettison handle/initiators; all connectors, tees, and manifolds or one-way transfers; all explosive charges; and all explosive shaped charges. Each SMDC segment is loaded with 1 to 2 grains per foot of hexanitrostilben I (HNS I). When initiated, the extremely high velocity and pressure of the cord is focused onto the end of the next adjacent SMDC segment, which acts as an acceptor charge.

Shielded Mild Detonating Cord (SMDC) Manifold.— Two SMDC manifolds are located on the pilot's and copilot's bulkhead. The SMDC manifold acts as a check tee or one-way detonating transfer device. The SMDC manifold is a self-contained unit housing a sealed receptacle for dual-shaped charges. Any detonation entering the side ports from either direction will transfer to the aft port. Any detonation originating from the aft port (TACCO or SENSO) segment of the SMDC manifold will not transfer back into the side portions. This would occur when either the TACCO or SENSO elects to cut the respective hatch; the remaining two windows and the opposite hatch would not be affected.

MAINTENANCE REQUIREMENTS

Maintenance on ejection seats is primarily performed during aircraft inspections. The ejection system could be called a dormant system, as it is only operated in an emergency situation. A true functional test of the complete system cannot be performed because of the destructive functions of some of the components. For this reason it is of the utmost importance that you thoroughly know all aspects of the ejection system that you perform maintenance on and follow all the steps for testing components as outlined in the maintenance instructions manual (MIM).

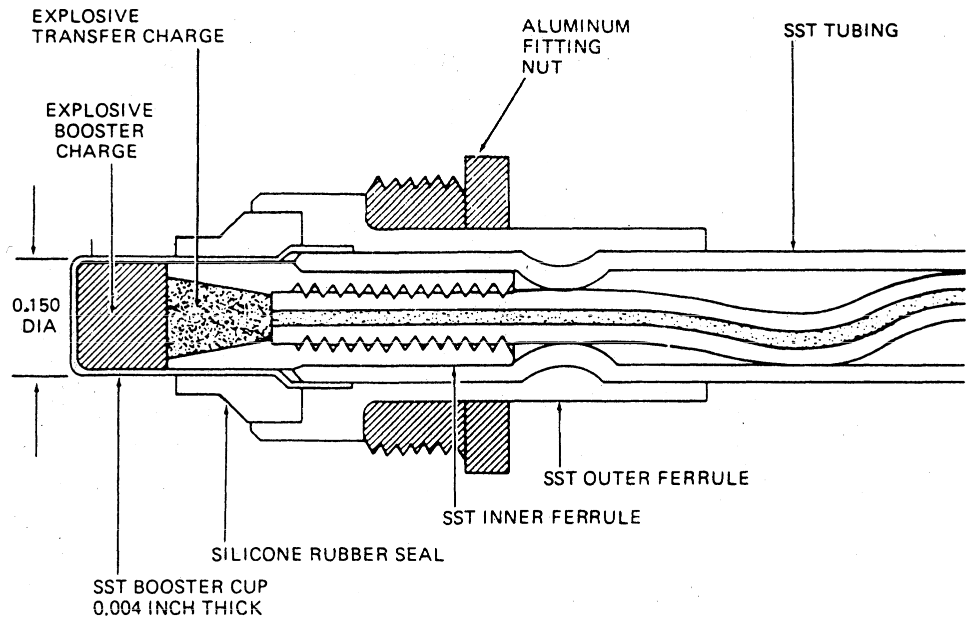


Figure 6-12.—Shielded mild detonating cord tip (typical).

WARNING

Do not perform maintenance on equipment with installed cartridges except in the presence of personnel capable of rendering aid if necessary.

Seat Removal and Installation

Before entering the cockpit, ensure that all seat and canopy safety pins and devices are properly installed. Check that the ejection control safety handle (fig. 6-13) (head knocker) is in the down and locked position. Ensure that the pilot's and copilot's eject mode selector handles are set to the SELF EJECT position.

Remove the parachute and survival kit by disconnecting the oxygen and communications quick-disconnect. Disconnect the emergency oxygen and emergency radio beacon quick-release lanyard attached to the aircraft's structure. Squeeze the harness release handle and disengage from holder. Remove the parachute actuator arming cable from the handle, and pull upward on the handle until the harness release actuator locks in the MANUAL DETENT position. Reseat the handle into the holder.

Withdraw the inertia reel straps from the chute roller fittings. Rotate the aft end of the survival kit up and forward to release the forward mounting hooks from the seat mounting brackets. Remove the parachute and survival kit from the aircraft and deliver to the aviators equipment work center.

If the seat is not in the full down position, apply electrical power and lower the seat to the full down position. Do not hold the seat adjust switch in the UP or DOWN position for more than 15 seconds to prevent damage to the seat height actuator.

Remove the M99 initiator actuating cover and install safety pins in the initiators (fig. 6-5). The pilot and copilot seats require two safety pins, and the TACCO and SENSO seats require one safety pin. Remove, as required, overhead window or hatch assembly. Remove cover from top of the

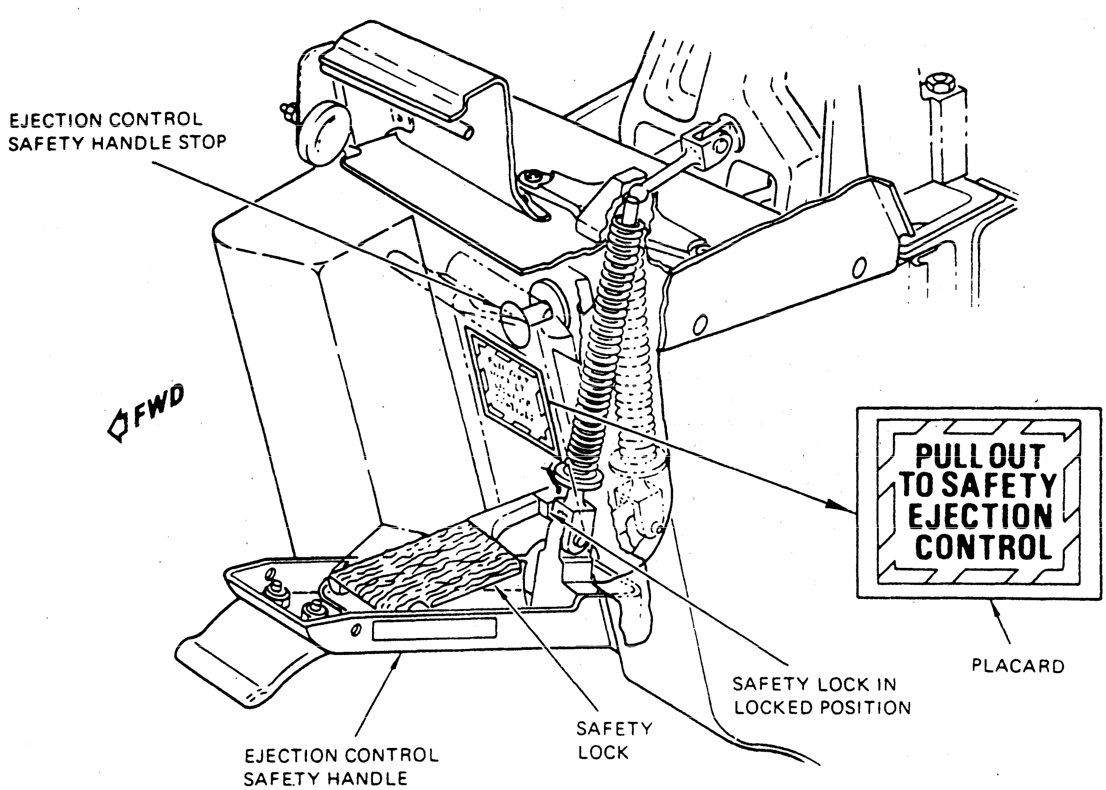


Figure 6-13.—Ejection control safety handle.

rocket catapult (fig. 6-14). Disconnect the inertia reel ballistic hose quick disconnect using the special key and flag assembly.

Attach the hoisting sling to the seat and overhead hoist. Using the hoist, apply upward pressure on the seat to prevent damage to the seat/rocket during removal of the trunnion bolt. Remove the trunnion bolt and ensure that all seat connections have been disconnected. Raise the seat with the hoist. As the seat reaches the top of the guide rails, prevent the yaw vane from deploying. Caution must be taken to prevent injury to maintenance personnel as the yaw vane is deployed by a 40-pound spring force. Continue raising the seat until the lower rollers on the seat clear the guide rails. After the yaw vane trip lever has passed the cam on the outboard guide rail, reset the yaw vane latch. Lower the seat and secure it to the ejection seat cradle.

CAUTION

Do not rest the seat on the STAPAC cover on the bottom of the seat.

The seat installation is essentiality a reversal of the removal procedures.

NOTE: The following text provides information for in-shop maintenance of the ESCAPAC lE-1 ejection seat.

Primary Ejection Control

Pull forward and down on the primary ejection control handle (face curtain handle) to

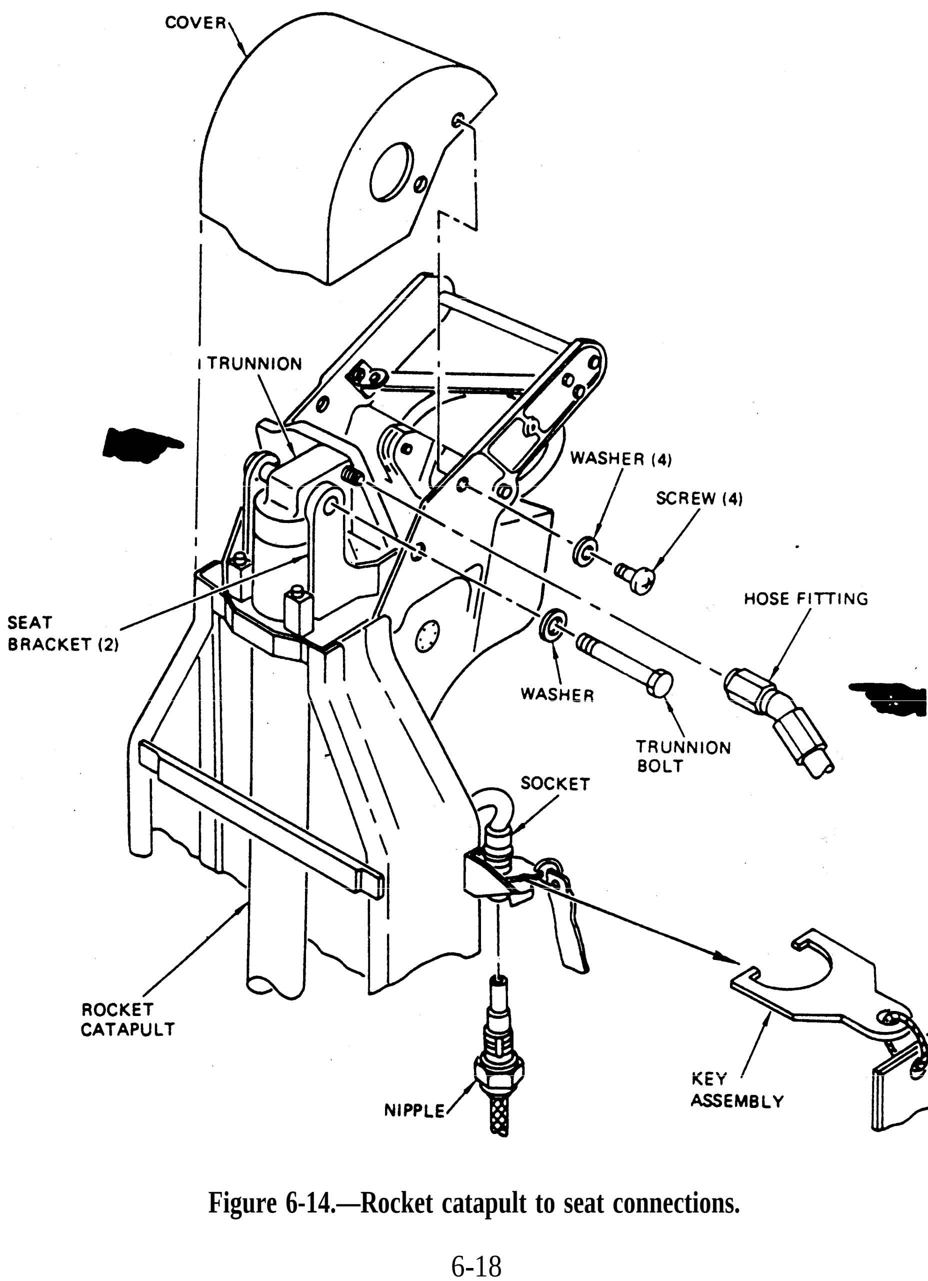


Figure 6-14.—Rocket catapult to seat connections.

disengage the handle plungers from their detent retainers. Reach behind the seat and move the firing control disconnect cable (fig. 6-15, callout A) sideways to unlock the firing control disconnect fitting. Continue to slowly pull on the face curtain until the cable ball ends pull free.

Inspect the screen assembly for damage or deterioration and that it has a valid expiration date, if applicable. Reinstall the face curtain.

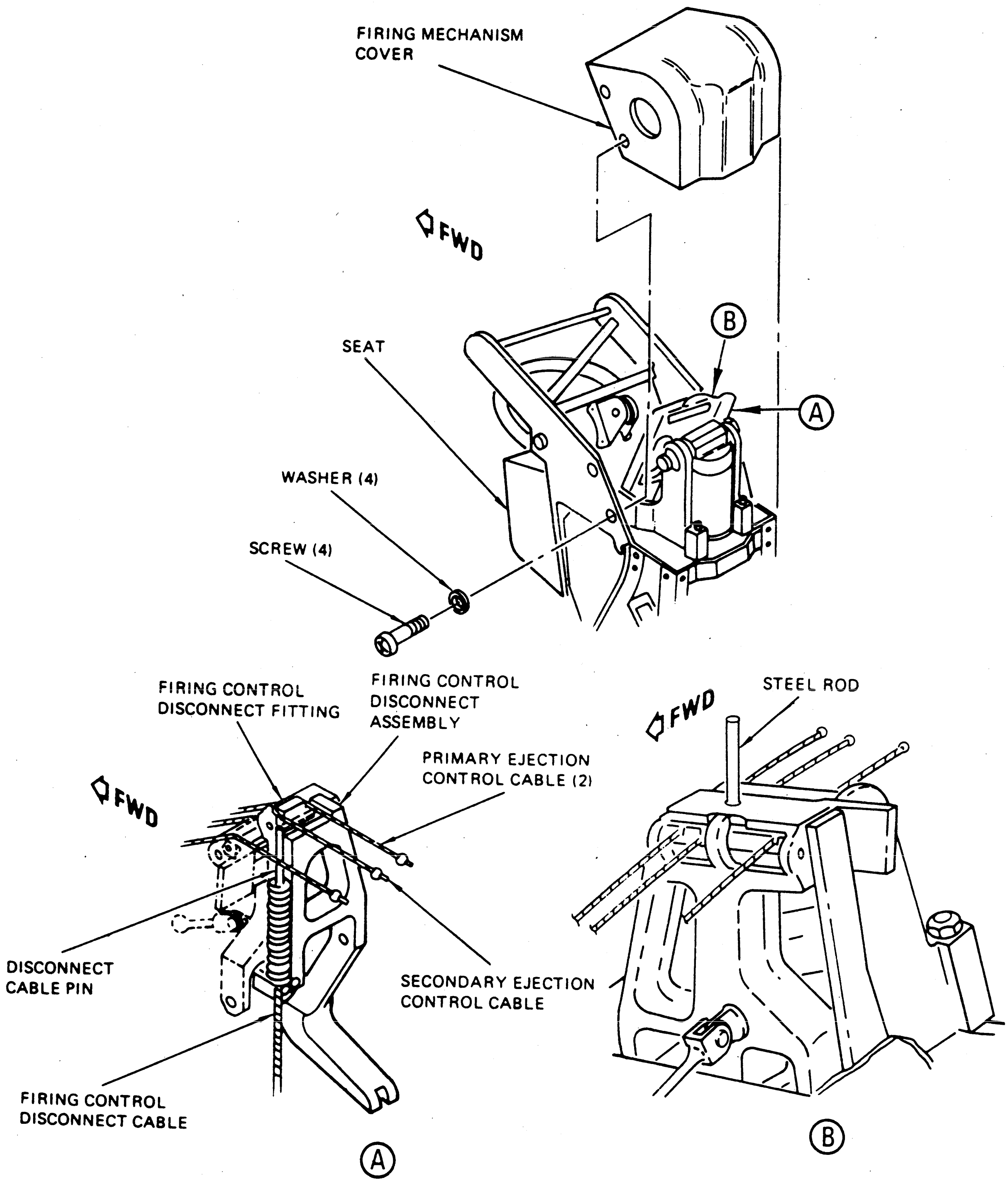


Figure 6-15.—Firing control disconnect fitting and pin.

Ensure that the face curtain screens convex surface is facing upward. Feed the two screen cables through their respective grommets in the back wall of the curtain stowage compartment. Fold the curtain into accordian pleats and stow in the compartment. Snap the screen handle plungers into their retainer detents, ensuring that there is no fabric lodged between the plungers and detents. Insert the screen cable ball ends into their respective slots in the firing control disconnect fitting. Ensure that the secondary ejection control cable ball end (center one) is installed in the disconnect fitting also. Rotate the top of the fitting aft until the fitting is reset. With the screen assembly pull test adapter and push-pull spring scale in place, perform the ejection controls pull test (fig. 6-16) on the face curtain by pulling forward and downward on the face curtain handle observing the force required to unseat the plungers from their retainers detents. The force must be 30 ± 10 pounds. Fold and restow the face curtain.

Secondary Ejection Control

Attach push-pull spring scale to the secondary ejection control handle and pull upward on the scale. A force of 25 ± 2 pounds is required to unseat the handle from the stowed detent position.

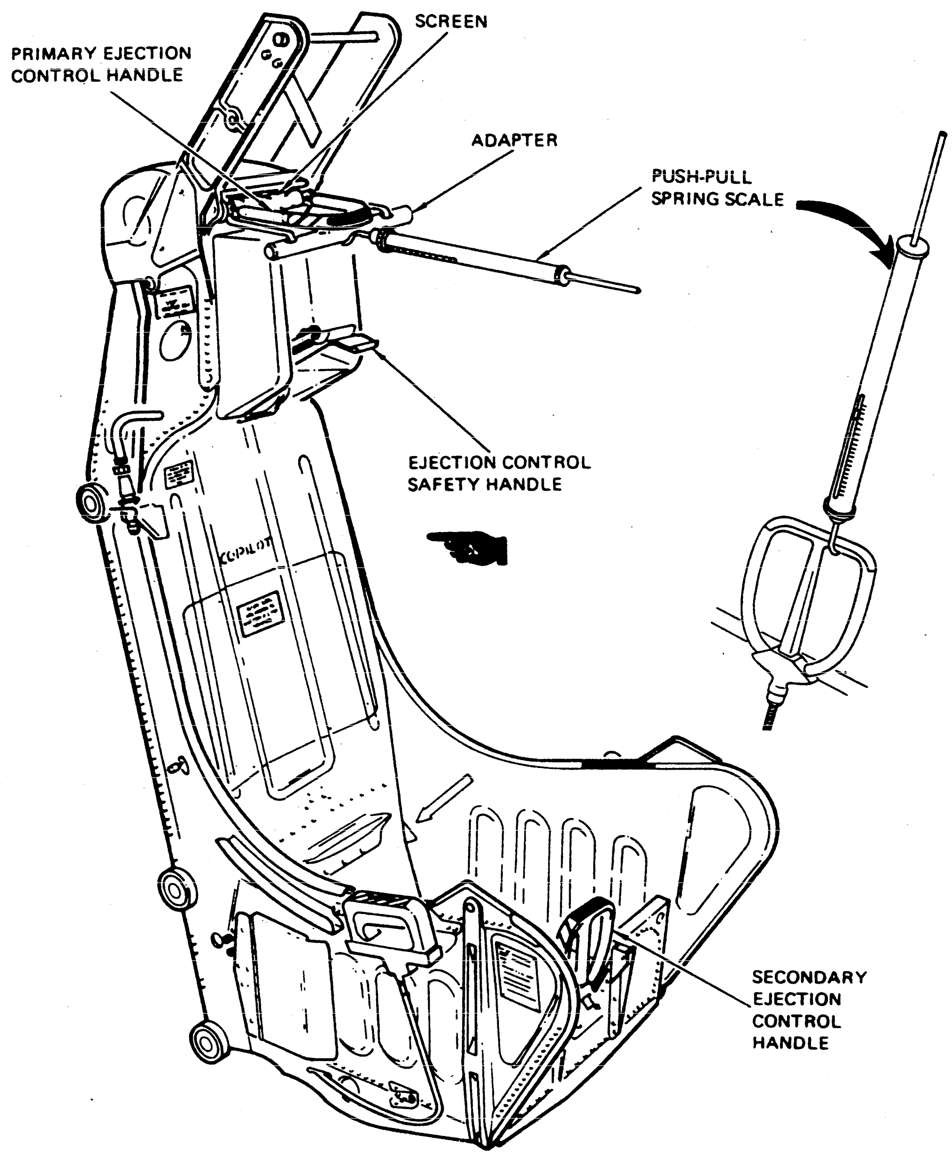


Figure 6-16.—Ejection control pull test.

Verify that the handle will extend not less than 0.75 inch from the handle stowed position. Remove the spring scale and restow the handle in the holder.

Power Inertia Reel

Place the inertia reel control lever in the unlocked position. Extend the inertia reel straps, ensuring that they extend and retract freely and that the inertia reel action is smooth. Inspect the straps for deterioration and fraying and replace as required. With the inertia reel control handle in the unlocked position, while extending the straps, accelerate the motion sharply to simulate 3 g's. If the inertia reel does not lock, it must be replaced.

Place the control lever in the locked position and allow the straps to retract into the reel. ensure that random pull checks during rewind allow no more than 2 inches of extension at any check.

Harness Release Actuator

With the blast shield removed from the rear of the seat, inspect the harness release actuator and attaching hardware for corrosion or damage. With the harness release piston in the fully extended position (fig. 6-17), measure from the bottom of the actuator housing to the clevis

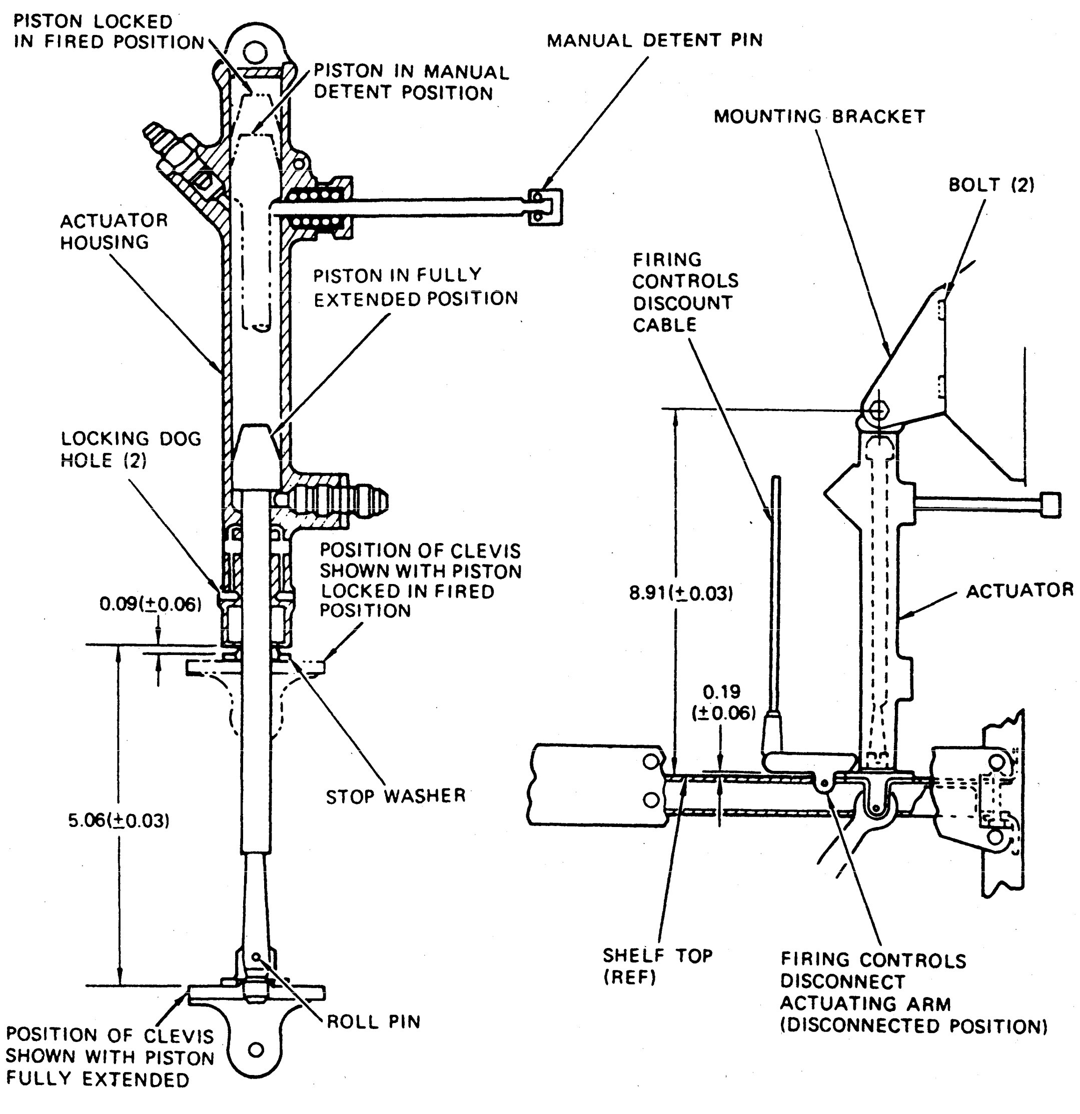


Figure 6-17.—Harness release actuator adjustment.

shoulder; it should be 5.06±0.03 inches. If not, remove the roll pin and adjust the clevis as required. With the piston in the fired position, verify the clearance between the bottom of the actuator housing and stop washer on top of the clevis is 0.09±0.06 inches. To release the piston from its fired position, with two 1/8-inch rods inserted into the locking dog holes, pry down on the two rods to spread the locking dogs and pull the piston out of the fired detent position.

Move the piston to the full down position by pulling out on the manual detent pin, and continue pulling downward on the piston. Ensure that there is a clearence of 0.19 ± 0.06 inch between the firing controls disconnect actuating arm and the shelf top with the harness release disconnect actuating arm in the disconnect position.

With a push-pull spring scale, pull slowly upward on the harness release handle until the manual detent pin engages the harness release acutator piston. The force required to lock the piston should not exceed 40 pounds. Remove the spring scale and continue pulling upward on the harness release handle, ensuring that the handle has a minimum of 0.125 inch of over travel from the manual detent position.

To check the firing control disconnect pin travel (fig. 6-15, callout B), insert a 1/8-inch diameter rod in the hole at the top of the firing control disconnect assembly. Mark an index line on the rod at the exact top of the hole in the firing control disconnect assembly. Pull upon the harness release handle (in overtravel position) and ensure that the rod does not exceed 3/16 inch of downward travel from its original up position. If travel exceeds 3/16 inch, adjust the lock pin to this tolerance. This test simulates firing control disconnect pin travel, and excessive travel could prevent seat ejection as a result of overtravel movement of the harness release handle. This causes unseating of the firing control disconnect fitting and release of the ejection control cables.

Reset the harness release handle into the holder and pull the manual detent pin to reset the harness actuator. Verify that the lap belt and shoulder harness retaining pins protrude through the seat structure a minimum of 0.06 inch, not including the tapered end of the pin.

EMERGENCY SURVIVAL EQUIPMENT

The emergency survival equipment (fig. 6-18) accompanies the crewman during ejection or ditching. It can sustain life, aid rescue during emergency conditions, and provide support and comfort to the crewmen during normal operation. The survival equipment consists of all equipment used after seat/man separation from the ejection seat.

Parachute NES-12E

The parachute is designed for use in rocket catapult ejection seats. The parachute is a backpack-type assembly that normally opens automatically, but it can be deployed manually by pulling the conventional rip cord D-ring. The parachute is connected to the RSSK-8A-1 survival kit by two nylon harness straps running from the bottom of the parachute to the back portion of the survival kit.

Survival Kit RSSK-8A-1

The survival kit is connected to the ejection seat by lugs on the back of the survival kit, which engage detents in the survival kit lug retaining pins. The retaining pins are integral parts of the harness-release bell crank assembly.

The survival kit is a two-piece fiber glass container with top and bottom sections. A foam pad cushion is positioned on top of the kit to provide comfort for the crew member. A manual kit-release handle on the right side of the kit provides for separation of the two survival kit halves and release of the survival gear. The top half contains the emergency oxygen bottle, which is automatically actuated by a cable attached to the aircraft structure as the ejection seat moves up the guide rails during the ejection sequence. The oxygen bottle is normally used for high-altitude ejections, but it can be manually actuated, if the normal oxygen supply fails, by pulling the emergency oxygen lanyard located on the inboard side of the front thigh support of the survival kit. The bottom half of the kit contains a life raft, a radio transmitter (if installed), and a survival kit bag. The life raft is folded and stowed in the front section of the kit. A self-contained pneumatic bottle automatically inflates the raft upon separation from the kit. A battery-operated radio transmitter is automatically switched on during the ejection sequence by an aircraft-attached lanyard. The survival kit bag is a zippered bag stowed next to the life raft. The bag contains dye markers, seawater desalter, sponge, two escape and evasion kits, rations, sunburn ointment, signal distress flares, signal mirror,

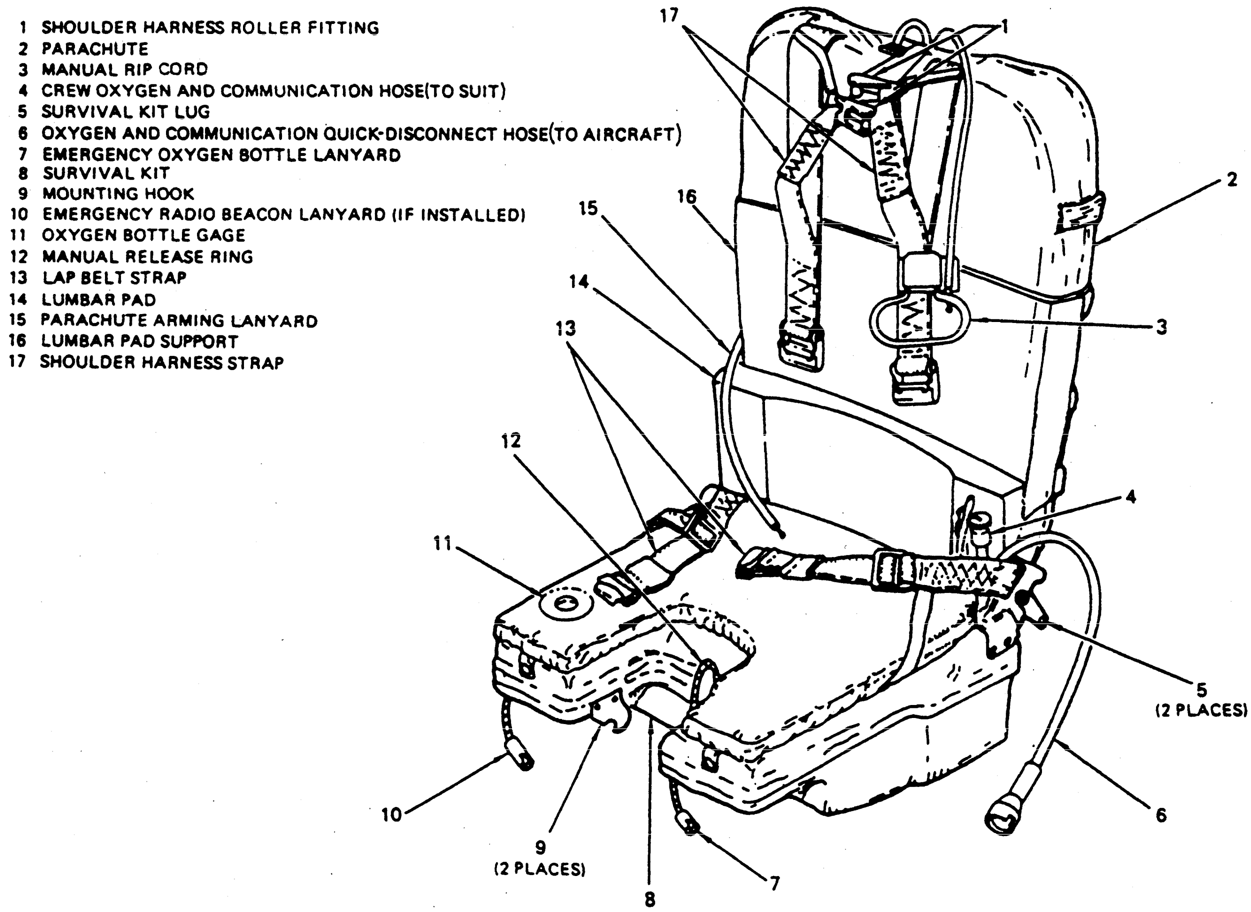


Figure 6-18.—Survival kit and parachute removed.

emergency code card, water storage bag, a 50-foot nylon cord, and shark repellent.

Operation

As the seat moves up the guide rails during seat ejection, the aircraft-attached emergency oxygen lanyard is pulled automatically to actuate a supply of emergency oxygen. In the event of high-altitude ejection, the emergency oxygen provides protection against blackout while the crew member is descending to a safe altitude. By pulling the manual kit-release handle on the right side of the kit, the crew member may deploy the kit during parachute descent. Upon deployment of the kit, the top and bottom halves separate; both halves are still connected to the crew member by a retaining lanyard. The survival kit gear remains with the bottom half of the container (stowed in a zippered bag), while the life raft separates from the container. A self-contained pneumatic bottle automatically inflates the life raft, which remains attached to the crew member by means of the retaining lanyard.

Parachute deployment occurs following the crew member/seat separation phase of normal seat ejection. If the crew member is above a preset pressure altitude of 14,000 (± 500) feet, an aneroid in the parachute barometric actuator delays parachute deployment until the crew member has descended to the correct pressure altitude. The parachute actuator delay cartridge then fires, causing parachute deployment. The parachute also can be deployed manually by pulling a conventional D-ring rip cord.

CARTRIDGES AND CARTRIDGE-ACTUATED DEVICES (CADs)

The types of explosive devices incorporated in egress systems are varied. The AME working with these devices must know how they function, their characteristics, how to identify them, their service-life limitations, and all safety precautions. The AME who understands the importance of all of these factors and who correctly uses the maintenance manuals is better equipped to supervise and train others. Always refer to the manual, *Cartridges and Cartridge-Activated Devices* (NAVAIR 11-100-1). The manual contains cartridge information and safety precautions for handling explosives.

Initiators

As previously discussed, initiators, such as the M99, start an action. Initiators are explosive devices, and no maintenance is allowed on explosive devices. When installing explosive devices or during aircraft inspections, initiators will be verified for expiration, and if newly installed they will be marked with an approved marking medium with all the information required by the cartridge manual, NAVAIR 11-100-1.

Delay initiators serve the same function as initiators, but they have a built-in delay charge to allow another function to be performed before they fire. An example would be a 0.5-second delay initiator installed in the line to the rocket motor of the forward seat in a two-place aircraft. This would allow the rear seat to clear the aircraft first by delaying the firing of the forward seat ejection rocket for 0.5 second.

Detonating Cord

Detonating cord is installed between different components of an ejection system, taking the place of pneumatic gas lines. The detonating cord is a stainless steel tubing filled with an explosive, and is more reliable and much faster than comparable pneumatic gas systems. The system is also safer from the standpoint of inadvertent actuation due to the extremely high initiating velocities, and pressures, as previously discussed.

Rocket Catapult

The rocket catapult, MK 16 MOD 1, used in the S-3 aircraft is rated as a class B explosive. The MK 16 MOD 1 is a self-contained, gas-initiated, two-phase, solid-propellant booster and rocket. The rocket catapult consists of two gas-initiated firing mechanisms, a solid-propellant booster assembly, a rocket launching tube, a gas-initiated rocket igniter, a solid-propellant rocket motor, and an output cartridge for actuation of other gas initiated escape devices.

Each firing mechanism consists of one firing pin (shear pinned in place) mounted inside a special fitting that combines the inlet port and firing mechanism housing. Two inlet port/firing mechanism housings are threaded into each base cartridge assembly.

The catapult tube assembly consists, primarily, of a cartridge assembly, lock, unlock sleeve, unlock piston, unlock spring, outer housing, motor lock disk, mounting bracket, and front body housing.

The rocket motor assembly consists, primarily, of a steel motor tube with canted nozzle assembly and a tungsten insert, a solid-propellant grain, an ignition charge, an output cartridge assembly, and a seat mounting lug to facilitate attachment to the aircraft ejection seat.

FUNCTION.— When the aircrewman pulls the face-curtain ejection handle or the alternate ejection handle or when the sequential ejection system is actuated, an external initiator begins the catapult operation by forcing gas through the inlet fitting(s) into the cartridge assembly of the rocket catapult. This gas pressure provides the force necessary to shear the pins that hold the rocket catapult firing pins in place. The firing pins then develop the energy necessary to fire the percussion primers in the cartridge assembly. The percussion primer then fires the ignition material within the cartridge assembly, which, in turn, ignites the booster cartridge. The piston unlock ring then moves downward, compressing the unlock spring and releases the lower tangs of the lock assembly.

After the lower tangs of the lock assembly have been released, movement of the rocket motor assembly begins. As gas from the main cartridge charge expands and drives the assembly up the catapult tube, the nozzle is kept sealed by the motor lock disk. Near the end of the catapult stroke, the motion of the unlock sleeve is stopped by interference with the front body housing, and the shear pins between the unlock sleeve and the rocket motor assembly are sheared. At this point, the rocket motor has achieved a velocity of approximately 50 feet. per second. When the rocket motor has traveled another

0.9 inch (approximately), the shoulder on the lock strikes the immobilized unlock sleeve and stops. This action releases the upper tangs of the lock and unseals the rocket motor nozzle by severing the nozzle plug and retaining the motor lock disk.

The hot, pressurized gases from the cartridge then pass into the rocket motor assembly through the nozzle. These gases energize the rocket motor firing mechanism, which ignites the rocket ignition material. The rocket ignition material and/or the hot gases from the booster cartridge ignite the rocket motor solid-propellant grain. The rocket motor then provides additional thrust to the aircrewman seat after separation of the booster and rocket sections.

The rocket motor internal pressure energizes two output cartridge firing mechanisms that fire the output cartridge. The output cartridge then actuates other escape devices, which are attached to the output fitting.

INSPECTION OF THE ROCKET CATAPULT.— The rocket catapult must be inspected whenever it is removed from the shipping container for use and prior to returning it to stowage. If the rocket catapult is found in a hazardous condition, explosive ordinance disposal (EOD) personnel must be immediately notified. After the rocket catapult is rendered safe, or if it is rejected for any other reason, it must be disposed of in accordance with NAVAIR 11-85-1.

Inspect the rocket catapult for damage, such as dents and corrosion; reject the unit if it has any visible defects. Inspect the head end cap for tightness by grasping the cross-shaped head end trunnion (word AFT stamped on face) with one hand and attempt to tighten the head end cap with the other. If any cap motion is detected, do not reject the unit but repair it in the following manner.

Back off head end cap until the U-shaped slot in the rocket motor tube is exposed. Inspect to see if the head end trunnion pin is completely contained within the U-shaped slot. If the entire pin is not visible within the slot, reject the unit.

NOTE: Pin is not necessarily bottomed in the slot.

If unit passes inspection, apply Locktite (grade N) to exposed thread area, hand tighten cap, and then tighten with strap wrench. Inspect the adjustment ring for tightness by grasping the cross-shaped head end trunnion (word AFT stamped on face) with one hand and attempt to tighten the adjustment ring with the other. If more than a few degrees of side-to-side play is evident in adjustment rings with six holes (two configurations of adjustment rings are in service—one with six holes and one without holes), reject the unit. If the adjustment ring without holes is found to be loose, do not reject the unit but repair it in the following manner.

Back off the adjustment ring until it contacts the head end cap, and apply Locktite sealant (grade N) to the exposed, degreased thread area. Ensure that the front body housing is tightened down against the catapult tube prior to hand tightening the adjustment ring against the front body housing. Allow Loctite sealant to set. Reinspect prior to use.

MARTIN-BAKER SJU-5/A EJECTION SEAT

Learning Objective: Recognize the components, seat system/subsystems, support components, system operations, component test and test equipment, and corrosion control procedures for the Martin-Baker SJU-5/A ejection seat.

The SJU-5/A ejection seat is a ballistic catapult and rocket system that gives the pilot a quick and safe means of escape from an aircraft. The seat system includes an initiation system that jettisons the canopy, positions the pilot for ejection, and fires the seat catapult. Canopy breakers on the top of the seat allow the seat capability to eject through the canopy should it fail to jettison.

As the seat ejects from the aircraft, a rocket motor on the bottom of the seat is fired. Then a drogue gun is fired to deploy two drogue parachutes. These parachutes either remain attached to the top of the seat or they are released to deploy the main parachute, depending upon the altitude and the number of g's applied to the seat. An automatic time-release mechanism opens the main parachute container and releases the drogue parachutes that deploy the main parachute.

SYSTEM OPERATION

Before flight, the ejection seat safe/arm handle is kept in the SAFE position. In this position, the visible portion of the handle is colored white and placarded as SAFE. When the aircraft is ready for flight, the pilot sets the safe and arm handle to the ARMED position. In this position, the visible portion of the handle is colored with yellow and black markings and placarded as ARMED.

The ejection sequence (fig. 6-19) starts when the pilot pulls the ejection control handle. The upward movement of the handle removes two sears from the seat initiator and fires two cartridges with the seat initiator.

Firing Sequence

Ballistic gas generated by the right cartridge within the seat initiator actuates the pin puller. The gas also activates the shielded mild detonating cord (SMDC) initiator. The SMDC then activates the aircraft identification friend or foe unit (IFF) and the canopy jettison system. Additionally, it activates the inertia reel cartridge and the 0.3-second delay initiator. Ballistic gas generated by the left cartridge within the seat initiator starts the 0.3-second delay initiator. Ballistic gas pressure from either 0.3-second delay initiators ignites the primary cartridge within the catapult.

Catapult Firing and Initial Seat Movement

Ballistic gas pressure developed by the catapult primary cartridge causes the inner and intermediate barrels within the catapult to rise and release the top latch mechanism. The secondary cartridges within the catapult fire progressively as the rising barrels are exposed to the heat and pressure of the primary cartridge gas. Progressive firing of the catapult secondary cartridges provides a relatively even gas pressure during catapult extension. This eliminates excessive g-forces during ejection.

As the seat moves upward, the emergency oxygen system is activated. A trip rod withdraws the firing link from the drogue gun and starts a 0.5-second internal timer. Another trip rod withdraws the firing link from the time-release mechanism. Aircraft electrical power and personal services (oxygen and communication) between the seat and the aircraft are disconnected.

At this point in the sequence, the leg restraint lines are drawn through the snubbing units to restrain the pilot's legs to the seat bucket. When the leg restraint lines become taut, the upper portion of the leg restraint line shears from the lower portion, which is attached to the floor bracket. Forward movement of the lines is prevented by the snubbing units.

After 72 inches of catapult extension, the rocket motor initiator is fired by a cable that is attached to the drogue gun trip rod. Ballistic gas pressure generated by the cartridge within the rocket motor initiator is routed to a pressure actuated firing mechanism located on the rocket motor. Flame and pressure ignite the rocket motor propellant grain. The thrust of the motor is approximately 4,500 pounds and lasts for 0.25 second.

Aircraft and Seat Separation

Separation of the seat from the aircraft occurs at approximately 76 inches of catapult extension. At this point, the inner barrel separates from the intermediate barrel. The seat is now clear of the aircraft.

The drogue gun primary cartridge fires after a 0.5-second delay to propel the piston from the drogue gun barrel. The inertia of the piston extracts the parachute flap closure pin and deploys the 22-inch controller drogue. The controller drogue, in turn, deploys the 60-inch stabilization and retardation drogue. The 0.5-second time delay allows the seat to reach its maximum altitude before the drogues are fully developed. The seat will stabilize and decelerate because of the drogues, which are held to the seat by the scissor mechanism.

If the drogue gun primary cartridge fails to fire, ballistic gas pressure will pass to the drogue gun when the time-release mechanism (TRM) fires. This gas shears the firing pin retaining pin. The firing pin then strikes the secondary drogue gun cartridge, which results in drogue deployment. Should both the drogue gun primary and time-release mechanism cartridges fail to fire, operation of the manual override handle will fire

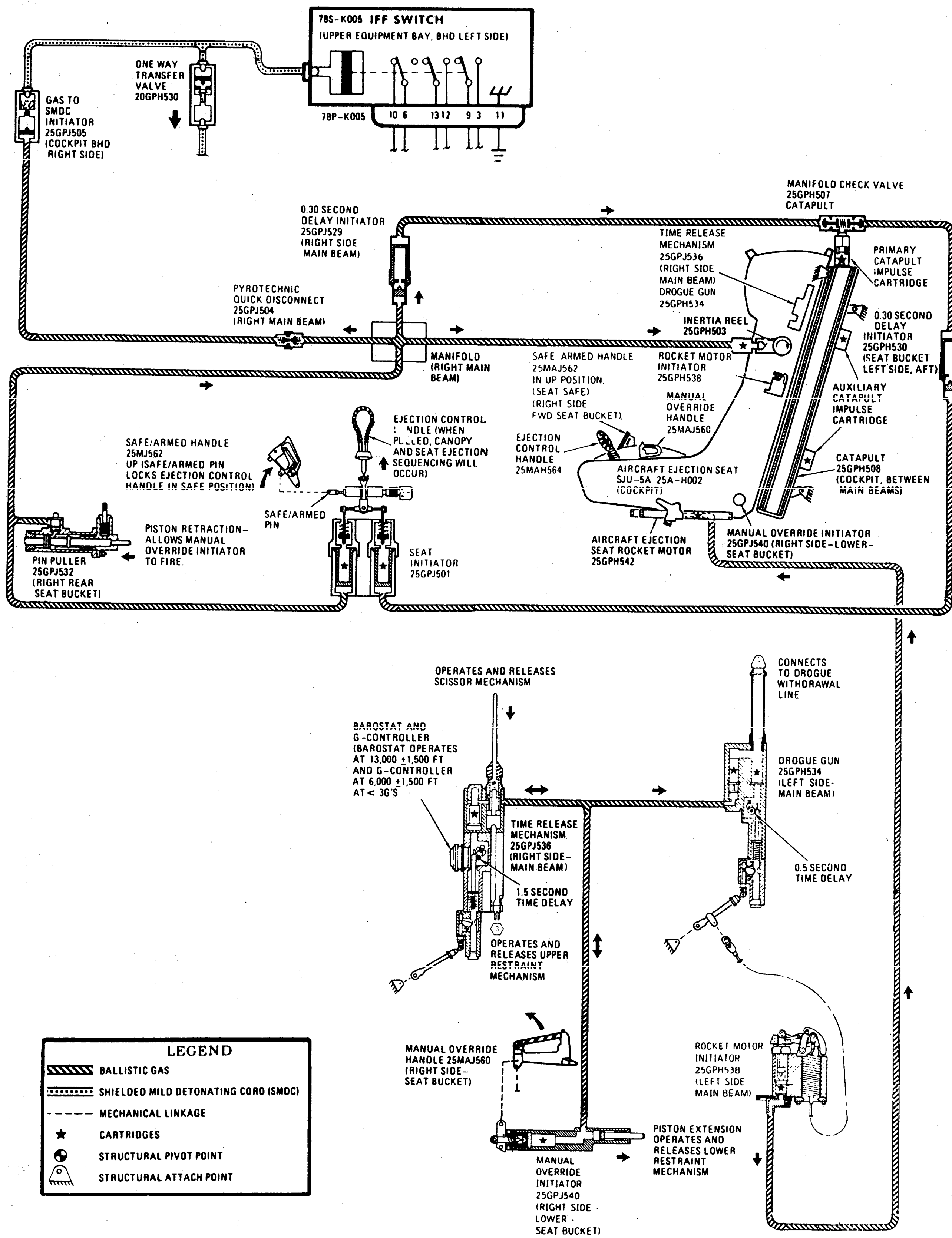


Figure 6-19.—Ejection seat sequencing schematic.

the manual override initiator cartridge. This duplicates the function of the TRM and fires the drogue gun secondary cartridge. The drogue gun then deploys the drogue parachutes and personnel parachute concurrently.

The TRM altitude-sensing barostatic time release prevents the 1.5-second timer from starting at altitudes above 11,500 feet. The barostatic time release ensures that the pilot descends rapidly through the upper atmosphere to a more survivable altitude. At altitudes between 7,500 and 11,500 feet, the time delay for deployment of the personnel parachute is controlled by an internal g-limiter, which interrupts the timing sequence until the deceleration force is less than 1.5 g's. This results in lower parachute opening loads. At altitudes below 7,500 feet, the 1.5-second timer starts without interruption.

After the 1.5-second timer delay, the TRM cartridge fires. This releases the upper restraint mechanism, lower restraint mechanism, parachute mechanical lock, and drogue shackle. When the drogue is free from the scissor mechanism, it deploys the personnel parachute. The personnel parachute lifts the pilot and the survival kit from the seat and pulls the sticker-clip strap lugs from their clips. This is necessary to ensure that collision between the seat and the pilot is avoided. The radio beacon activates when pilot and seat separation occurs. Then a normal parachute descent begins.

While descending in the parachute, the pilot can pull the survival kit handle to separate the kit halves. This allows deployment and automatic inflation of the life raft. The life raft and survival kit items are connected by a lanyard to the survival kit lid, which is attached to the pilot.

SYSTEM COMPONENTS

The SJU-5/A ejection seat system (fig. 6-20) provides support for the pilot during normal flight conditions and a method of escape from the aircraft during emergency conditions. Selected seat system components are discussed in the following paragraphs and keyed to figure 6-20.

Catapult

The catapult (3) is a cartridge-actuated device that provides the initial force required to eject the seat from the aircraft. The catapult is located within the main beam assembly (6) and is attached to the bulkhead of the cockpit by two mounting lugs. The ejection seat is installed on the catapult with three pairs of slippers located on the inboard side of the main beam assembly. The main beam assembly fits into catapult guide rails located on the outboard sides of the catapult's outer barrel. The ejection seat is locked to the catapult by the top latch mechanism. The catapult consists of three major parts: the inner barrel, the intermediate barrel, and the outer barrel.

INNER BARREL.— A neck-shaped piston head, fitted with a set of expander and piston rings, is attached to the lower end of the inner barrel to provide a gas seal with the intermediate barrel. A breech is located at the upper end of the inner barrel for the primary firing mechanism and cartridge. The breech has a groove on the outside edge into which the plunger of the top latch mechanism of the ejection seat is engaged.

INTERMEDIATE BARREL.— The intermediate barrel is located between the inner barrel and the outer barrel. The intermediate barrel increases the length of catapult extension. It also restrains bending loads incurred during ejection. A piston head fitted with two sets of six expander and piston rings is attached to the lower end. The piston head serves as a gas seal between the intermediate barrel and the outer barrel. A guide bushing is riveted to the upper end of the intermediate barrel to keep the inner barrel steady during extension. The guide bushing rivets are sheared by the neck-shaped piston head of the inner barrel during ejection. This allows separation of the inner and intermediate barrels. Twelve pressure rings are installed on the intermediate barrel to absorb the inertia forces encountered during barrel separation.

OUTER BARREL.— The outer barrel houses the intermediate and inner barrel assemblies. Two breeches are located on the aft side to accept the auxiliary cartridges. Two guide rails are bolted on the outboard sides of the outer barrel. The lower end is used to attach the catapult to the aircraft. The upper end has a square aperture to engage the plunger of the top latch mechanism. The upper fitting is threaded for the guide bushing that retains the intermediate barrel. The guide bushing is locked in place by a dowel screw.

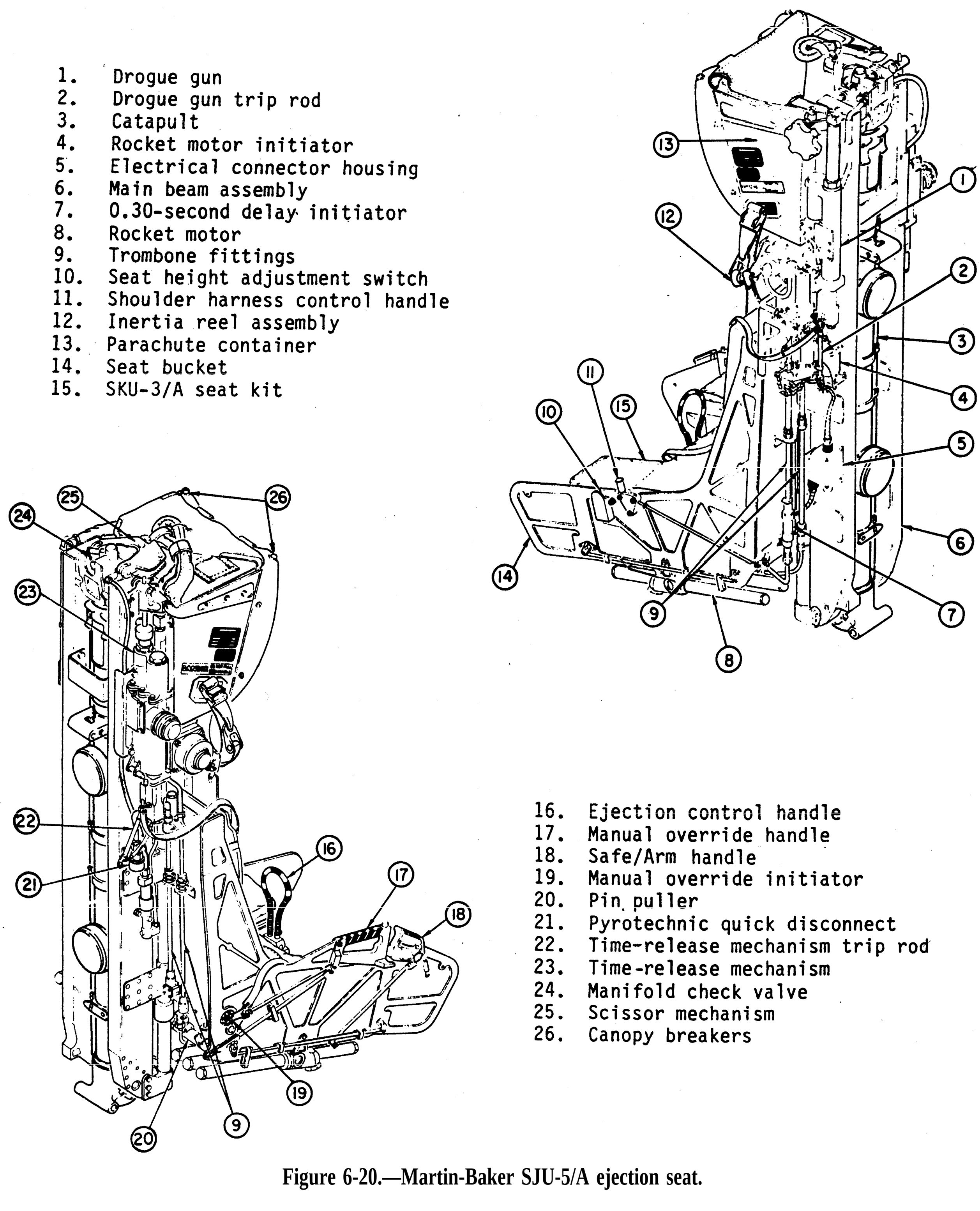


Figure 6-20.—Martin-Baker SJU-5/A ejection seat.

Manifold Check Valve

The manifold check valve (24) (figs. 6-20 and 6-21) provides an interface between the ejection seat and the catapult. The manifold check valve is mounted to the top of the catapult. The valve is held against the primary firing mechanism by a spring-loaded plunger and a retaining pin. The valve contains two inlet ports, which connect the hoses from the 0.30- and 0.30/0.75-second delay initiators. Internal check valves ensure that 400 to 600 psi gas pressure is maintained at the catapult primary firing mechanism.

Main Beam Assembly

The main beam assembly (6) (fig. 6-20) is the main structure of the ejection seat. The main beam assembly consists of left and right vertical beams bridged by three cross members. The assembly supports the major components of the ejection seat. Three slippers are bolted to the inboard side of each beam to engage the guide rails on the catapult outer barrel. The upper cross member is used to hold and correctly position the top of the catapult. This member withstands the full thrust of the catapult during the ejection sequence. The bolts that attach the upper cross member to the main beam assembly also attach the top latch mechanism to the left beam. The inertia reel (12) and the upper attachment for the seat height actuator are mounted to the center cross member. Two tabular tubes are secured to the center and lower cross members. The tubes have two sliding runners that attach to the seat

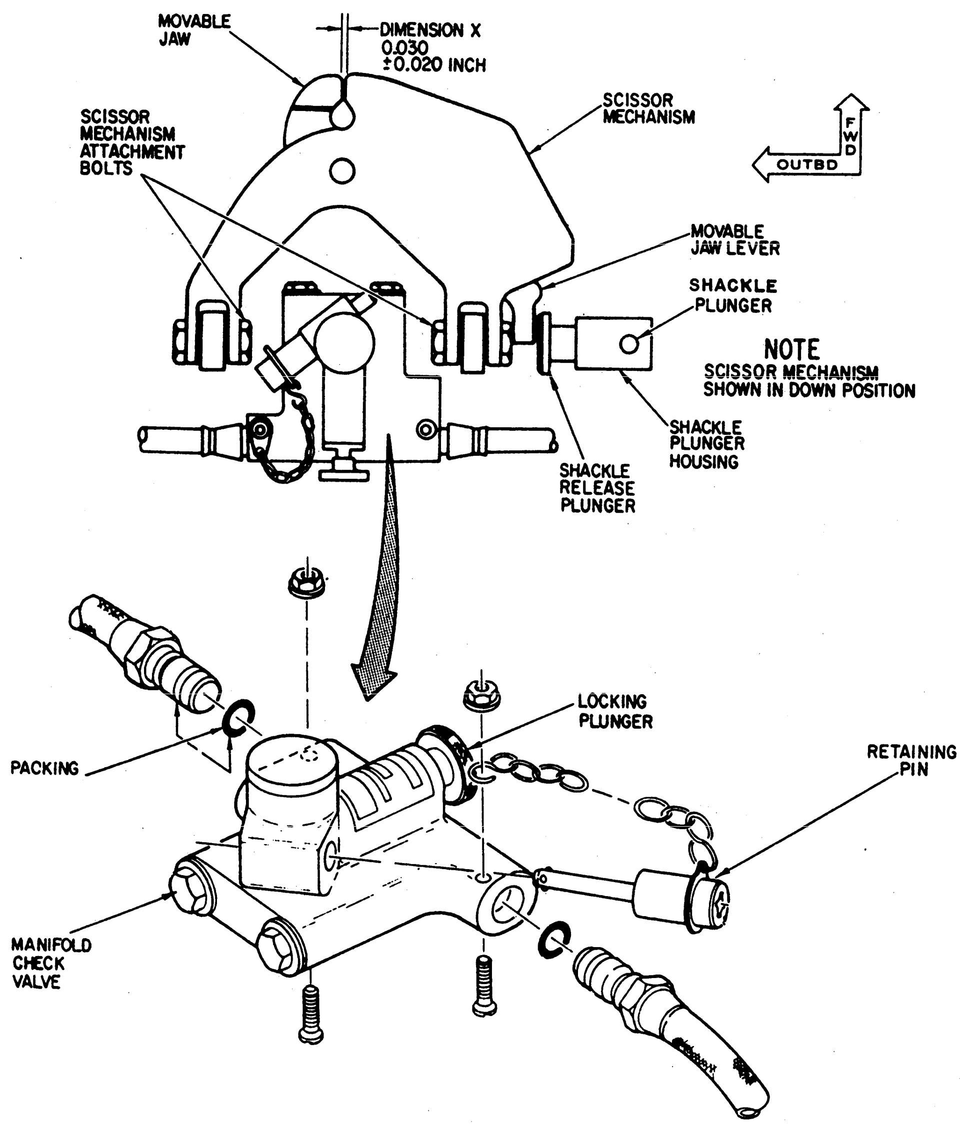


Figure 6-21.—Scissor mechanism and manifold check valve.

bucket. The seat height actuator rod is attached to the lower sliding runner. The components attached to the main beam assembly are discussed in the following paragraphs.

TOP LATCH MECHANISM.— The main beam assembly is secured to the catapult by the top latch mechanism, which is located on the upper end of the left beam. The mechanism consists of a housing with a spring-loaded plunger. The inboard end of the plunger is shaped to engage the catapult inner barrel. The outboard end is threaded to accept the top latch handwheel. When the handwheel is installed, it permits removal of the ejection seat from the catapult.

SCISSOR MECHANISM.— The scissor mechanism (25) (fig. 6-20) (also shown in fig. 6-21) is located on top of the main beam assembly upper cross member. It retains the drogue parachutes after they are deployed and prevents deployment of the personnel parachute until a safe altitude and g-force is reached. The scissor mechanism has a moveable jaw, which is held in the closed position by the shackle plunger of the upper body of the time-release mechanism.

TIME-RELEASE MECHANISM.— The time-release mechanism (TRM) (23) (fig. 6-20) (also shown in fig. 6-22) is mounted on the outboard side of the right beam. The TRM automatically releases the drogue parachutes, deploys the personnel parachute, and releases the pilot from the ejection seat at the proper time in the ejection sequence.

The TRM consists of a time-delay mechanism, barostat assembly, barostatic g-controller, spring-loaded firing mechanism, connecting rod,

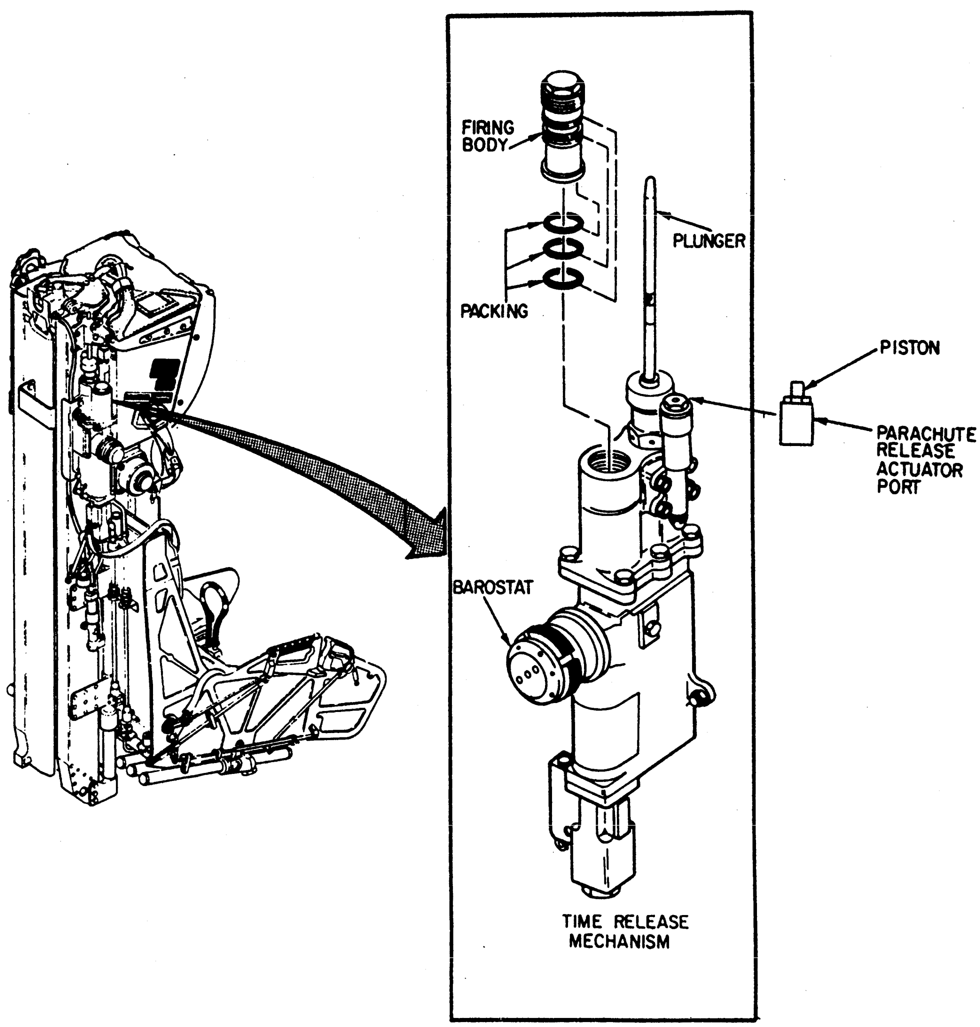


Figure 6-22.—Time-release mechanism.

cartridge, and a shackle plunger assembly. The shackle plunger is secured in the scissor shackle plunger housing to lock the scissor mechanism in the closed position, as shown in figure 6-21. In this position, the drogue shackle is secured to the ejection seat. Gas lines connect the TRM to the manual override initiator and to the secondarys cartridge of the drogue gun. A piston located on top of the upper body engages the parachute mechanical lock to secure the personnel parachute.

The TRM 1.5-second time-delay mechanism delays seat/man separation and deployment of the personnel parachute until the drogue parachutes stabilize and decelerate the ejection seat. The barostat assembly delays the deployment of the personnel parachute until the pilot and the ejection seat descend to 14,500 feet. This delay prevents prolonged descent in the upper atmosphere. When ejection occurs above 7,500 feet, a barostat g-controller delays the deployment of the personnel parachute until deceleration loads are less than 3 g's.

DROGUE GUN.— The drogue gun (1) (fig. 6-20) (also shown in fig. 6-26) is mounted on the outboard side of the left beam. The drogue gun deploys the drogue parachutes during the ejection sequence. The drogue gun incorporates a 0.5-second delay to ensure that the ejection seat has cleared the cockpit prior to deploying the drogue parachutes. The gun consists of a body and a barrel assembly.

The drogue gun body contains a time-delay mechanism, a spring-loaded firing pin, and two cartridges (primary and secondary). The barrel assembly contains a piston that is held in place by a shear pin. The barrel holds the primary cartridge and water seal. The primary cartridge is mechanically fired by a trip rod attached to the cockpit bulkhead.

A chamber connected by a gas passage to the barrel holds the secondary cartridge and a gas-operated firing mechanism. This chamber ensures that actuation of either cartridge will fire the piston from the barrel.

INERTIA REEL ASSEMBLY.— The inertia reel (12) (fig. 6-20) is mounted on the center cross member of the main beam assembly. During normal operation in the UNLOCK position, the inertia reel is free to extend or retract as required by the pilot's movements, but an automatic lock feature will prevent rapid forward movement. When the rapid movement ceases, the inertia reel returns to normal operation. When the inertia reel is in the LOCKED position, it will retract the straps but will not allow them to extend. When the ejection sequence is initiated, a pyrotechnic cartridge is used to activate the inertia reel. This retracts and locks the pilot into the correct position for ejection.

ROCKET MOTOR INITIATOR.— The rocket motor initiator (4) (fig. 6-20) is mounted on the outboard side of the left beam. The rocket motor initiator consists of a cartridge chamber, a firing mechanism, and a coiled static line. The chamber is attached to the trombone fittings (9) by an outlet connector. The static line is coiled into a plastic container. The upper end of the line is attached to the quadrant lever and the lower. end is attached to the drogue gun trip rod.

SEAT HEIGHT ACTUATOR.— The seat height actuator is mounted in the main beam assembly forward of the catapult gun. The actuator permits adjustment of the seat bucket within a vertical travel of approximately 5 inches. The seat height actuator consists of an electric motor and housing, gearbox, bearing housing, and jackscrew assembly.

AIRCRAFT SEAT PARACHUTE.— The aircraft seat parachute container (13) (fig. 6-20) is located near the top of the main beam assembly. The parachute consists of a 22-inch controller drogue, a 5-foot stabilizing main drogue, and a 17-foot personnel parachute. The controller drogue deploys the -stabilizing drogue that decelerates and stabilizes the ejection seat during the initial phase of the ejection sequence. The personnel parachute provides the pilot with a safe means of descent. The parachute container provides support for the pilot's head during forward acceleration or wind blast.

The personnel parachute is packed in the container first. It is secured by flaps and a closure pin that is attached to the personnel parachute withdrawal line. The withdrawal line attaches the main drogue to the apex of the personnel parachute. Then the main and controller drogues are packed. They are secured by four flaps and a closure pin, which is attached to the drogue withdrawal line. The drogue shackle secures the parachute withdrawal line and extender strap. Then the drogue shackle is secured in the scissor mechanism.

Seat Bucket

The seat bucket (14) (fig. 6-20) is mounted on the lower forward side of the main beam assembly. It is attached to studs on the seat bucket runners. The components described in the following paragraphs are related to the seat bucket.

EJECTION CONTROL HANDLE.— The ejection control handle (16) is located on the front of the seat pan. It is the only means by which ejection can be initiated. The handle is molded in the shape of a loop and is connected to the sears of the ejection seat initiators. The seat initiators have two rigid lines that connect to the trombone fittings. An upward pull of the loop removes both sears from the dual initiators to initiate ejection. Either initiator can fire the seat. After ejection, the handle remains attached to the seat. The ejection control handle is safetied by using the ejection seat safe/arm handle and safety pin.

EJECTION SEAT SAFE/ARM HANDLE.— To prevent inadvertent seat ejection, an ejection seat safe/arm handle (18) is installed. To safety the seat, you must rotate the handle up and forward. To arm the seat, you rotate the handle down and aft. When in the ARMED position, the portion of the handle that is visible to the pilot is colored yellow and black with the word ARMED showing. In the SAFE position, the visible portion of the handle is colored white with the word SAFE showing. By placing the handle to the SAFE position, it causes a pinto be inserted into the ejection firing mechanism. This prevents withdrawal of the sears from the dual seat initiators.

SHOULDER HARNESS CONTROL HANDLE.— The shoulder harness control handle (11) and seat height adjustment switch (10) are mounted on the left side of the seat bucket. The shoulder harness control handle is connected to the inertia reel. The seat height adjustment switch controls electrical power to the seat height actuator motor.

MANUAL OVERRIDE HANDLE.— The manual override handle (17) is located on the right side of the seat bucket. The handle is connected to the lower restraint mechanism. It is also connected to the manual override initiator.

MANUAL OVERRIDE INITIATOR.— The manual override initiator (19) is mounted in a covered compartment in the lower aft right side of the seat bucket. A linkage connects the sear to the manual override handle. Pulling the handle releases the lower restraints. Full upward movement of the handle is prevented by the pin puller. However, during ejection, the pin puller is automatically retracted. This allows the manual override handle to pull the sear from the manual override initiator, which will override the automatic sequencing. This is accomplished by routing gas pressure to the time-release mechanism and the secondary cartridge of the drogue gun.

PIN PULLER.— The pin puller (20) (fig. 6-20) (also shown in fig. 6-23) is located on the aft right side of the seat bucket. Full aft rotation of the manual override handle is prevented by the pin puller. A pin extended from the pin puller engages a slot in the manual override linkage. During the ejection sequence, gas pressure from the right seat initiator cartridge retracts the pin.

ROCKET MOTOR.— The rocket motor (8) is attached to the bottom of the seat bucket. A rigid line from the rocket motor firing mechanism is connected to the inboard trombone fitting on the aft left side of the seat bucket. The trombone fitting interfaces with the rocket motor initiator, which is located on the main beam assembly.

The rocket motor consists of a firing mechanism, igniter cartridge., manifold, four nozzles, and 17 propellant tubes. Gas pressure from the rocket motor initiator forces the firing mechanism into the igniter cartridge. The rocket motor ignites as the catapult nears the end of its extension and raises the ejection seat to a height sufficient for a safe ejection, even if the aircraft has zero speed and zero altitude. The rocket motor produces approximately 4,500 pounds of thrust for 0.25 second. The nozzles on the seat are positioned forward and outward. This positioning allows the thrust to pass close to the center of gravity of the ejection seat and pilot.

SEAT SURVIVAL KIT.— The SKU-3/A seat survival kit (fig. 6-24) consists of a two-piece bonded fiber glass container and a seat cushion. The kit is located in the seat bucket and functions as a seating platform for the pilot. The survival kit contains the torso harness attachments, locking system, retaining lanyard, survival equipment, radio beacon, and emergency oxygen. A bracket for insertion of the negative-g strap is mounted

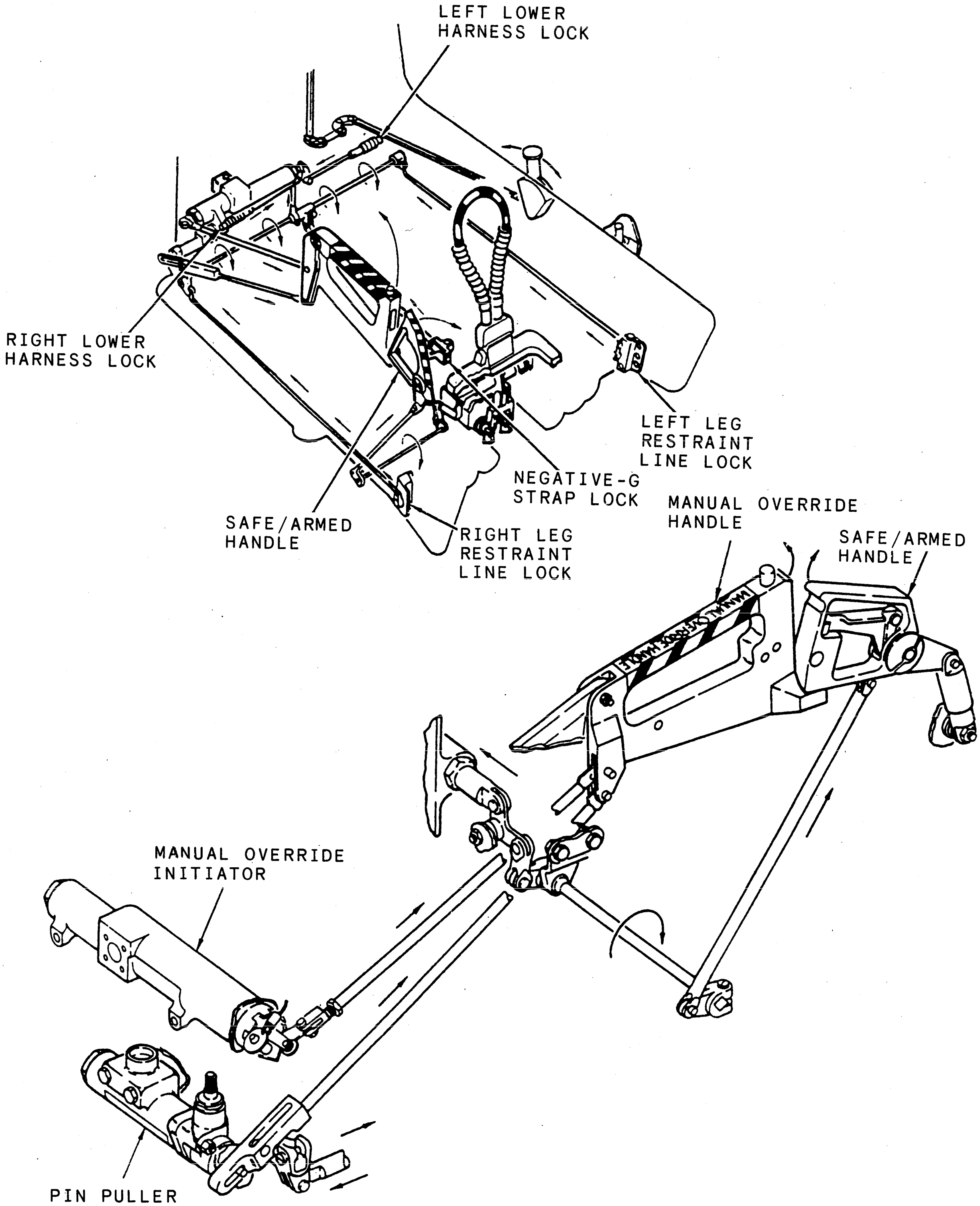


Figure 6-23.—Manual override system.

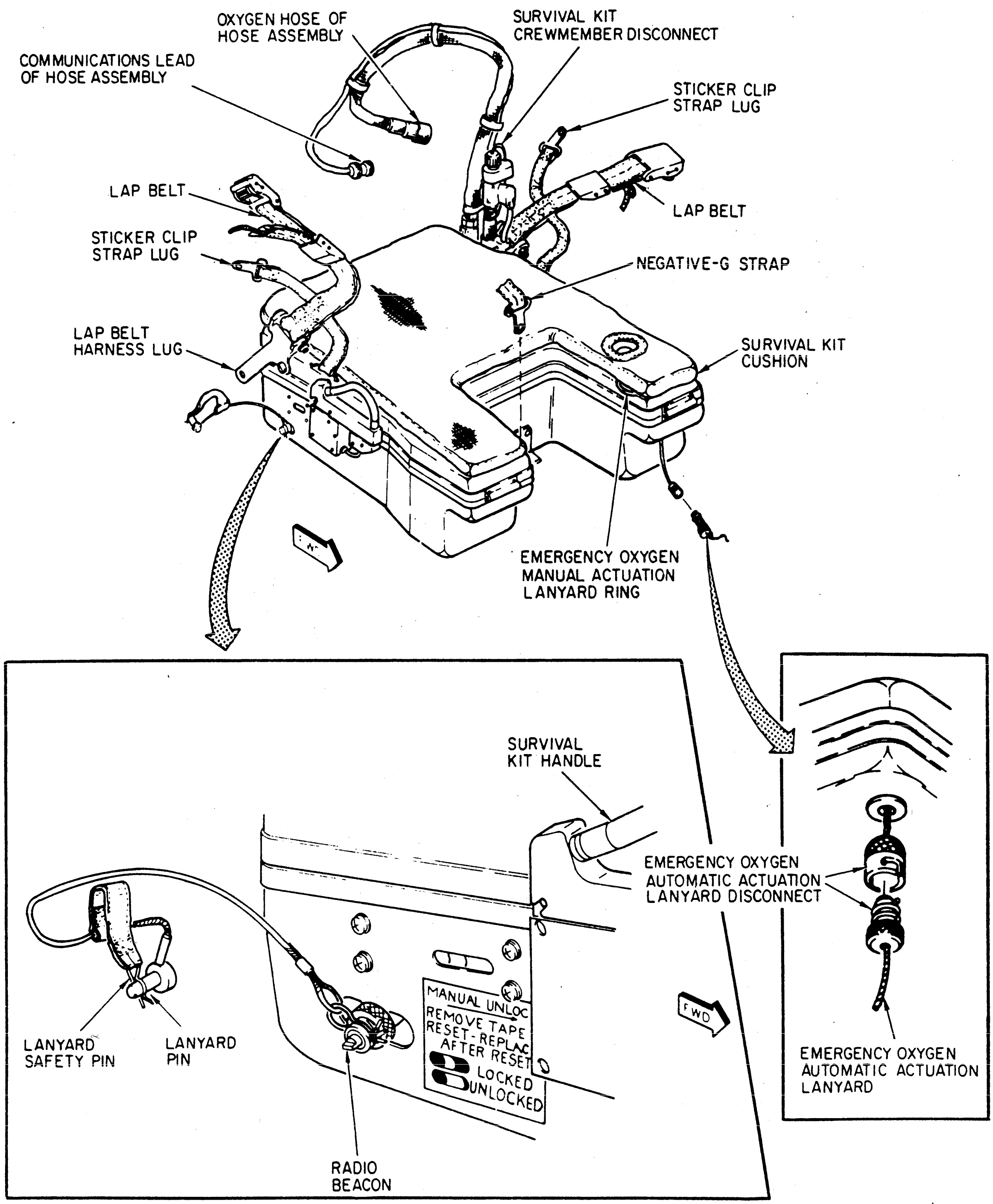


Figure 6-24.—SKU-3/A survival kit.

on the forward lower half of the survival kit. The emergency oxygen system, located in the lid of the survival kit, consists of an emergency oxygen cylinder, reducer assembly, actuation assembly, and manifold assembly. A lanyard and quick-disconnect fitting provide automatic actuation of the emergency oxygen system during ejection. If the aircraft oxygen system fails, emergency oxygen is available by actuating the emergency oxygen manual release. The release is a green ring located on the forward left side of the survival kit. A mounting is provided for the radio locator beacon and lanyard. The lanyard actuates the beacon upon ejection.

LEG RESTRAINTS.— Two leg restraint line snubbing units and lines are mounted to the forward structure of the seat bucket. The leg restraint lines are secured in locks located on the inboard sides of the seat bucket.

The leg restraints secure the pilot's legs to the seat during ejection. They consist of two adjustable leg garters, a restraint line, and a snubber unit for each leg. One garter is worn on the thigh and one on the lower leg. The restraint lines are routed through the garter rings and the snubber unit. One end of each restraint line is secured to the cockpit floor and the other is secured to the seat by a releasable pin. During ejection, the slack in each line is taken up and the leg lines separate at the tension rings. When the pilot and seat separate, the pins are normally released by the time-release mechanism. They may also be released by pulling the manual override handle. Both the lower garter and thigh garter contain a quick-release buckle. The leg restraint line runs through a ring that is disconnected by the buckle. This permits the pilot to exit the aircraft while wearing both the upper and lower garters.

The lower restraint mechanism locks are located in the lower aft portion of the seat bucket. These locks are connected by a cross shaft and linkage to the leg restraint line locks and the negative-g strap lock.

COMPONENT OPERATION

The operation of SJU-5/A system components and subsystems is discussed in the following paragraphs.

Catapult

A firing pin in the catapult firing mechanism is actuated by ballistic gas from the 0.3-second delay initiator. The firing pin then strikes the catapult primary cartridge. The ballistic gas from the primary cartridge starts the inner and intermediate barrels to extend upward. The upward movement of the inner barrel releases the spring-loaded top latch plunger from the retaining groove on the inner barrel.

As the inner barrel continues to extend upward, the ports of the inner and intermediate barrels expose the secondary cartridges. The secondary cartridges are ignited by the pressure and heat of the primary cartridge. The secondary cartridges assist in propelling both barrels and seat upward. After approximately 37 inches of travel, the piston head on the intermediate barrel contacts the pressure rings. These rings absorb the inertia force. The inner barrel continues to extend until it contacts the inner guide bushing. The inner barrel shears the rivet connecting the inner guide bushing to the intermediate barrel. This shearing separates the inner and intermediate barrels. The intermediate and outer barrels remain with the aircraft. The inner barrel remains with the ejection seat.

Manifold Check Valve

Gas from the delay initiators enters the manifold check valve and causes two internal check valves to be depressed. Then gas pressure passes to the catapult primary firing mechanism and severs the shear pin holding the firing pin.

Main Beam Assembly

The main beam assembly supports the major components of the ejection seat. The operation of the components supported by the main beam assembly is discussed in the following paragraphs.

TOP LATCH MECHANISM.— When the ejection seat is installed on the catapult, the top latch handwheel is removed. The top latch mechanism plunger passes through a hole in the outer barrel of the catapult and engages the locking groove. A locked indication is given by the position of the plunger and the indicator within the top latch mechanism housing. When the locking indicator spring-loaded plunger and mechanism housing are flush with each other, the top latch mechanism is locked. To remove the seat, you must install the top latch handwheel on the top latch plunger. This releases the seat from the catapult gun.

DROGUE GUN.— As the ejection seat rises, the trip rod withdraws the firing link from the drogue gun firing mechanism. This releases the spring-loaded firing pin. Firing pin movement is slowed for 0.5 second by an escapement mechanism to allow the ejection seat to clear the aircraft. After a 0.5-second delay, the firing pin activates the primary cartridge. Heat and pressure from the primary cartridge cause the secondary cartridge to fire. The gas produced by both cartridges shears the shear pin and expels the piston from the drogue gun barrel.

The drogue withdrawal line is attached to the piston. When expelled, the piston withdraws the pin from the closure flaps of the parachute container and deploys the drogue parachutes. The secondary cartridge serves as a backup system to the mechanically fired primary system. The cartridges in the time-release mechanism and manual override initiator provide gas pressure to the gas-operated secondary firing mechanism of the drogue gun. If the drogue gun primary firing mechanism fails, the gas-operated secondary firing mechanism cartridge will be fired by the secondary cartridge and the combined gas pressure will expel the piston from the drogue gun barrel to deploy the drogue parachutes.

TIME-RELEASE MECHANISM.— As the ejection seat rises, the trip rod also withdraws the firing link from the TRM and releases a spring-loaded firing pin. Firing pin movement is prevented for 1.5 seconds by a barostat and g-controller. When the altitude of the seat is less than 14,500 feet and acceleration forces are less than 3 g's, the barostat and g-controller release the firing mechanism. After the 1.5-second delay, the firing pin activates the cartridge. The gas produced by the cartridge passes to the upper body chamber and forces the shackle plunger down. This allows the scissor mechanism to open. At the same time, the gas actuates the connecting rod in the lower body and opens the inertia reel locks. Gas pressure is also provided to operate the piston to release the personnel parachute, manual override initiator, and the drogue gun secondary cartridge.

SCISSOR MECHANISM.— When the TRM cartridge fires, the shackle plunger retracts into the upper body of the TRM. This action allows the movable jaw of the scissor mechanism to open and release the personnel parachute from the container.

INERTIA REEL ASSEMBLY.— During the ejection sequence, gas pressure is used to fire the inertia reel cartridge. The gas pressure forces the head of the piston along the cylinder. The horizontal movement of the piston is transmitted by a threaded drive screw to rotate the ratchet wheel. The rotation of the ratchet wheel retracts the inertia reel straps and restrains the pilot in the seat. Then the locking pawl locks the spools in the retracted position.

Extension of the inertia reel straps at excessive speed causes the governor pawls to rotate outward because of centrifugal force. They engage the rack on the housing, which prevents any additional extension of the straps. When the shoulder harness control handle is in the rear position, the system restrains the pilot from moving forward. With no tension applied to the inertia reel straps, the pawl will reset itself and disengage from the rack. This will allow free extension of the straps.

ROCKET MOTOR INITIATOR.— During the ejection sequence, the static line connected to the drogue gun trip rod and to the rocket motor initiator is withdrawn from the aft initiator housing. When the static line is extended to approximately 72 inches, a spring-loaded plunger is unlocked. The plunger rotates the quadrant lever and removes the sear from the firing mechanism. Removal of the sear fires the cartridge in the breech. The gas produced is routed to the rocket motor firing mechanism, which ignites the rocket motor.

AIRCRAFT SEAT PARACHUTE.— The drogue shackle, which contains the parachute withdrawal line and extender strap, allows the drogues to be deployed without extraction of the personnel parachute. A mechanical lock secures the parachute withdrawal line to prevent premature deployment until pilot and seat separation has occurred. The lock is released by a piston in the upper body of the time-release, mechanism.

The parachute risers are routed down the forward side of the parachute container. Quick-release fittings are located on the end of the risers and connect to the pilot's torso harness. The inertia reel straps are routed from the inertia reel, through the parachute riser roller fittings, and are secured in the inertia reel locks.

SEAT BUCKET SUPPORTED COMPONENTS

The seat bucket supports several components on the lower portion of the ejection seat. The operation of these components is discussed in the following paragraphs.

Ejection Seat Initiator

With the safe and arm handle in the down or ARMED position, an upward pull on the ejection control handle removes the two sears from the firing mechanisms and causes the two cartridges within the initiator to fire. Gas pressure from either cartridge will initiate seat ejection.

Manual Override Initiator

Aft rotation of the manual override handle positions the safe and arm handle up to the SAFE position and releases the lower restraint. In this position, the pin puller engages a slot in the manual override handle linkage and prevents actuation of the manual override initiator. During the ejection sequence, the pin puller is retracted inboard. This allows the manual override initiator to be actuated and override the automatic sequencing. Gas pressure from the manual override initiator is piped to the time-release mechanism and the secondary cartridge in the drogue gun.

Pin Puller

During the ejection sequence, gas pressure from the right seat initiator cartridge enters the pin puller and operates a spring-loaded ball lock. This allows the pressure to retract the pin and disengage it from the manual override linkage.

Seat Survival Kit

The seat survival kit is opened by operating the release handle located on the right forward side of the kit. During the ejection sequence, the oxygen hose and communication lead disconnect from the aircraft. The emergency oxygen and radio beacon are automatically actuated. During parachute descent, the pilot may operate the release handle to open the survival kit. This allows deployment and inflation of the life raft. The life raft and survival equipment are connected by a lanyard to the survival kit lid, which is attached to the pilot.

Manual Override System

Operation of the manual override handle will rotate the cross shaft of the lower harness locks, leg restraint line locks, and the negative-g strap lock. This is necessary for emergency ground egress from the aircraft. Full aft rotation of the handle is prevented by engagement of the pin puller piston in a slot of the manual override handle linkage. This prevents firing of the manual override initiator.

During the ejection sequence, gas pressure from the right seat initiator cartridge operates the pin puller to withdraw the pin puller piston from the slot in the manual override handle linkage. In the event of a time-release mechanism failure or drogue gun failure above barostatic altitude, aft rotation of the manual override handle will fire the manual override initiator. Gas pressure from the manual override initiator cartridge operates the lower harness release system. It will also pass up the trombone fitting and fire the time-release mechanism cartridge. This cartridge operates the upper harness release mechanism, scissor mechanism release plunger, and parachute lock. Additionally, the gas pressure passes to the drogue gun and fires the secondary cartridge.

Leg Restraint System

As the seat travels up the guide rails during the ejection sequence, the leg restraint lines are drawn through the snubbing units. This action pulls the pilot's legs aft against the seat bucket. As the seat continues to rise, the leg restraint lines become taut. When the force on the bottom fittings reaches approximately 900 pounds, the shear ring will shear. The shearing releases the lower portion of the leg restraint lines.

Automatic Harness Release System

Firing of the time-release mechanism cartridge moves the piston and connecting rod down and rotates the cross shaft. Rotation of the cross shaft releases the inertia reel locking plungers and releases the inertia reel straps. Simultaneously, gas pressure is routed down the trombone fitting to fire the cartridge in the manual override initiator. Gas pressure from the manual override initiator cartridge presses against the head of the piston. Movement of the piston rotates the bell crank lever and releases the spring-loaded locking plungers of the lower harness locks. This releases the lap belt lugs and rotates the cross shaft. Rotation of the cross shaft releases the looking plungers in the leg restraint line and negative-g strap locks.

COMPONENT TEST AND TEST EQUIPMENT

Ejection seats and associated components are carefully designated, manufactured, and tested to ensure dependable operation. Such equipment must function perfectly the first time it is used. Malfunction or failure to operate usually results in severe injury or death to crew members. You must use the utmost care in maintaining escape system equipment. Proper handling and strict compliance with the maintenance procedures presented in the maintenance instructions manuals (MIMs) and the maintenance requirements cards (MRCs) are mandatory and cannot be overemphasized.

NOTE: The information presented in this chapter must not be used in place of information provided in the MIM.

The SJU-5/A ejection seat undergoes a variety of functional checks during the 364-day special inspection. In-depth testing of the firing unit mechanisms, catapult gun, time-release mechanism, drogue gun, and a complete mechanical operational check is required. The time-release mechanism and drogue gun checks are discussed in the following paragraphs.

Drogue Gun Check-out

The drogue gun must be removed from the ejection seat to accomplish the check-out. You should make sure the drogue gun is disarmed before performing any maintenance on it. Then, you should remove the drogue gun barrel and piston and inspect them for damage and corrosion. The three tests used in the check-out are the time-delay test, the firing pin protrusion test, and the firing pin cocking test. These tests must be done with the barrel and piston removed. These tests are discussed in the following paragraphs.

TIME-DELAY TEST.— To complete the time-delay test, you should perform the following steps in sequence.

1. Install the drogue gun adapter on the time-delay test base. Connect the adapter electrical cables to the time-delay test set timer. Then connect the test set to a 110-volt ac 60-Hz power supply. An air source regulated to 80 psi is also required. Figure 6-25 reflects the correct mounting of the drogue gun to the test set.
2. Extend the ram connecting plunger by pressing the reset button on the test set. The reset

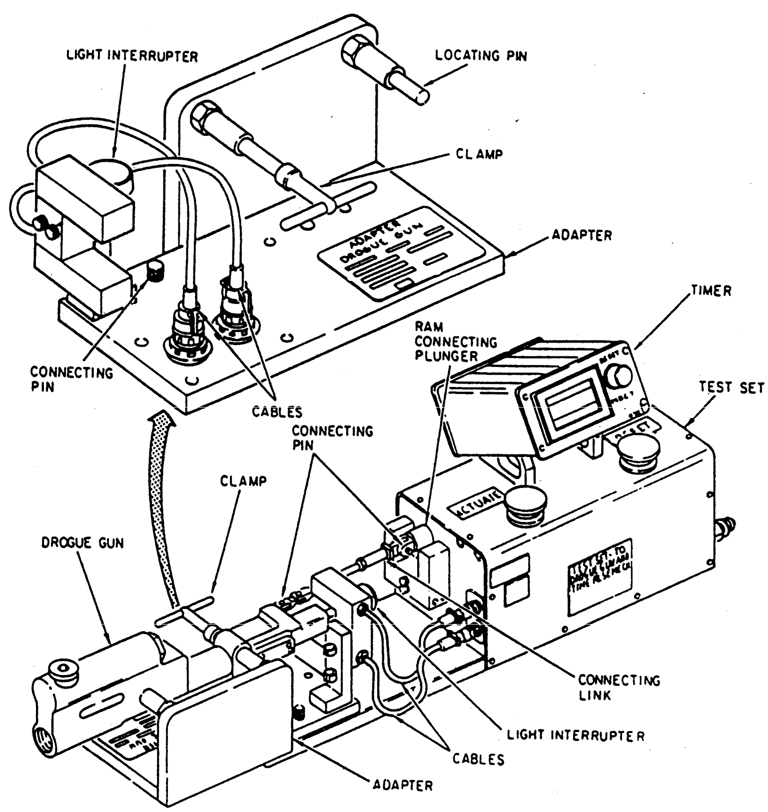


Figure 6-25.—Drogue gun time-delay check-out.

button also sets the timer to zero. Remove the lockwire from the drogue gun firing link and remove the hex head plug from the base of the drogue gun. Ensure the drogue gun is secured to the test set with the clamp. Next, attach the drogue gun firing link to the test set connecting ram plunger with the connecting link and connecting pins. Install the light interrupter into the base of the drogue gun.

NOTE: Before proceeding any further with the test, ensure quality assurance (QA) personnel are present to witness the results.

3. Press the time-delay test set actuate button and record the time required to pull the firing link from the drogue gun. The elapsed time should not exceed 0.5 ± 0.1 second. If the testis unsuccessful, the drogue gun must be replaced.

4. Remove the light interrupter and drogue gun from the test set and secure the equipment.

FIRING PIN PROTRUSION TEST.— To complete the firing pin protrusion test, you should perform the following steps in sequence.

1. Place the protrusion gauge over the firing pin.
2. Check the position of the inner center shaft of the gauge. It must be flush or slightly above the gauge outer case, as shown in figure 6-26.
3. If the firing pin fails this test, the drogue gun must be replaced.

FIRING PIN COCKING TEST.— To complete the firing pin cocking test, you should perform the following steps in sequence.

1. Place the drogue gun clamp into a vise and position the drogue gun on the clamp. Screw the cocking handle into the base of the drogue gun.

2. Pull the handle until the firing mechanism is fully extended. With the mechanism fully extended, install the firing link into the drogue gun.

3. Release the tension on the cocking handle. If the mechanism is cocked, the firing link will be held firmly in place.

4. Remove the handle and install the hex head plug and washer.

5. Lockwire the firing link to the drogue gun housing by inserting the lockwire through the housing and roll pin, which is attached to the firing link.

NOTE: At this point in the procedure, request QA to inspect the engagement and lockwiring of the sear.

Time-Release Mechanism Check-out

The time-release mechanism must be removed from the ejection seat to perform

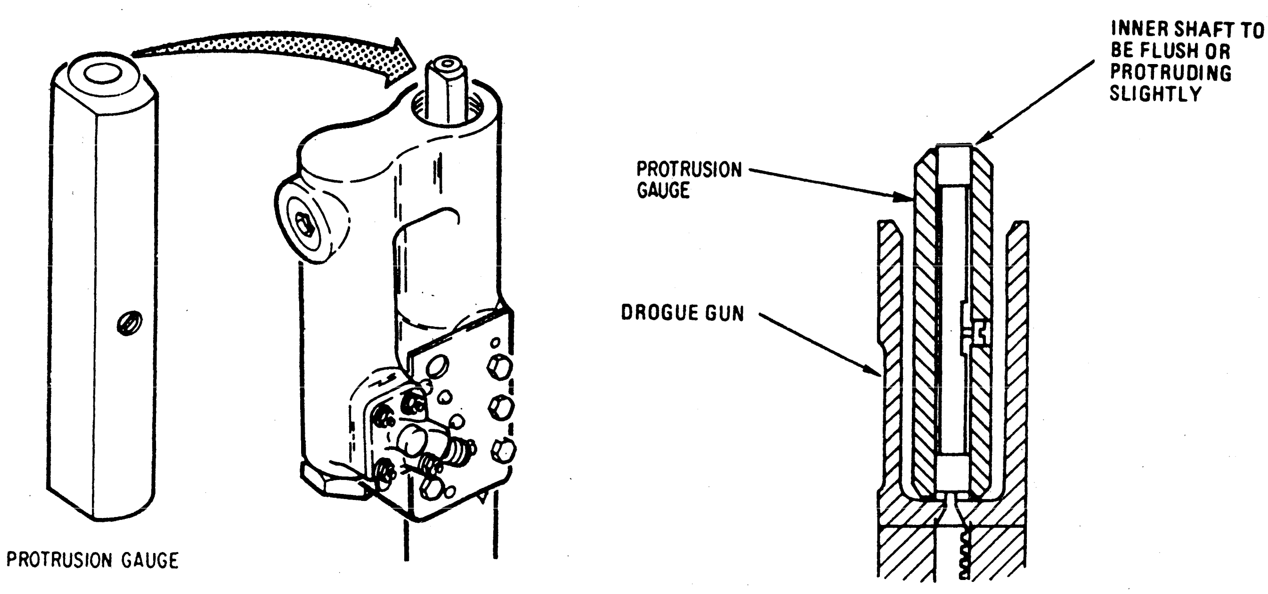


Figure 6-26.—Drogue gun firing pin protrusion check-out.

this check-out. You should ensure the TRM is disarmed before performing maintenance on it. Then, remove the firing body from the time-delay g-sensing release mechanism. Remove the lockwire from the firing link and remove the hex head plug and washer from the base of the unit. Inspect the TRM for damage and/or corrosion. If damaged or corroded, check the MIM for corrective action to be taken.

Time Delay Check-Out

To complete the time delay check-out, you should perform the following steps in sequence.

1. Remove the light interrupter from the test set and screw it into the base of the time-delay g-sensing release mechanism, as shown in figure 6-27. Install the TRM adapter on the time-delay test set base. Connect the adapter

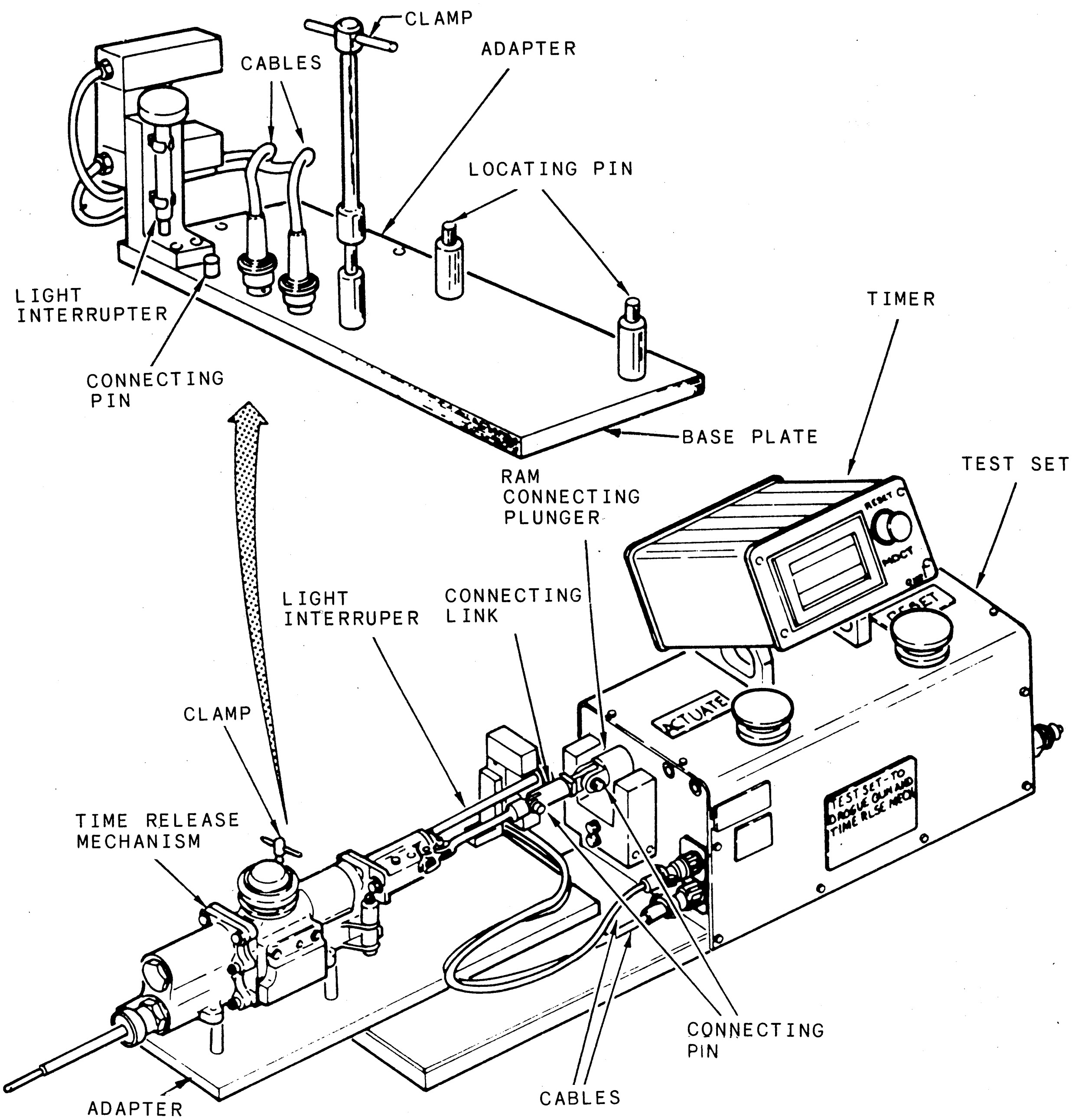


Figure 6-27.—Time-release mechanism time delay check-out.

electrical cables to the time-delay set timer. Then connect the test set to a 110-volt ac 60-Hz power supply. Again, you will need an air source regulated to 80 psi.

2. Extend the ram connecting plunger on the test set by pressing the reset button. Position the TRM on the test set and secure it with a test set clamp. Attach the time-delay g-sensing release mechanism firing link to the test set ram connecting plunger, connecting link, and connecting pins.

NOTE: At this point, you should ensure QA personnel are present to witness the elapsed time function.

3. Press the time-delay test set actuate button and record the time required to pull the firing link from the time-release g-sensing release mechanism. The elapsed time should not exceed 1.5 ± 0.1 seconds. If the time is greater than 1.5 ± 0.1 seconds, the unit must be replaced.

FIRING PIN PROTRUSION CHECK.— To complete the firing pin protrusion check, you should perform the following steps in sequence.

1. With the cartridge body removed from the TRM, place the TRM protrusion gauge over the firing pin.
2. Check the position of the inner center shaft of the gauge. It must be flush or slightly above the outer case of the gauge.
3. If the firing pin fails this test, it must be replaced.

FIRING MECHANISM COCKING TEST.— To complete the firing mechanism cocking test, you should perform the following steps in sequence.

1. Place the TRM clamp in a vise and position the TRM on the clamp. Screw the TRM cocking handle into the base of the TRM. Pull the cocking handle until the firing mechanism is fully extended.
2. In this position, install the test firing pin into the time-delay g-sensing release mechanism. The test firing pin is furnished as part of the TRM test set.
3. Release the tension on the cocking handle. Ensure the mechanism is cocked by pulling on the test firing pin. If the firing mechanism is cocked, it will be held firmly in place.
4. Remove the cocking handle from the TRM. Then remove the TRM from the clamp. The TRM is now cocked and ready for the barostat test check out.

Barostat Check-Out

To complete the barostat check-out, you should perform the following steps in sequence.

1. Connect the TRM test box to a 110-volt ac 60-Hz power supply. Ensure all protective plugs and parts of the test set are installed in the test box holes labeled “cocking control and altitude.”
2. Position the TRM in the test set and secure it with a clamp screw, as shown in figure 6-28.
3. Insert the operating handle through the hole in the test set labeled “firing control.” Screw the handle into the test firing pin.
4. Set the test box altimeter to 1013 millibars. With this setting, the altimeter will show a reading, in feet, above sea level and the altitude test will be relative to sea level.
5. Ensure the test set cover and seal are clean before closing the cover. A light application of pressure might be required to seal the cover.
6. Turn the vacuum release valve clockwise to the CLOSED position.

NOTE: Before you continue with the test, QA personnel should be present to witness the results.

7. Set the test set switch to the ON position. Make sure the vacuum pump starts and the red indicator light is illuminated.
8. While you monitor the test set altimeter, set the on/off switch to OFF when the altimeter reaches 30,000 feet.
9. Pull the operating handle to remove the test set firing pin from the TRM. The TRM should not operate at this time.
10. Monitor the test set altimeter while you slowly open the vacuum release valve. Open it until the altimeter indicates a steady descent rate, but not exceeding 200 feet per second.
11. Record the reading on the altimeter at which the TRM actuates. The actuation must occur at 13,000 ± 1,500 feet. If the TRM fails the test, it must be replaced.
12. After actuation, open the test set vacuum release valve. When the altimeter indicates zero, carefully open the test set cover.
13. Remove the clamp and disconnect the test firing pin from the TRM. Then remove the TRM from the test set.

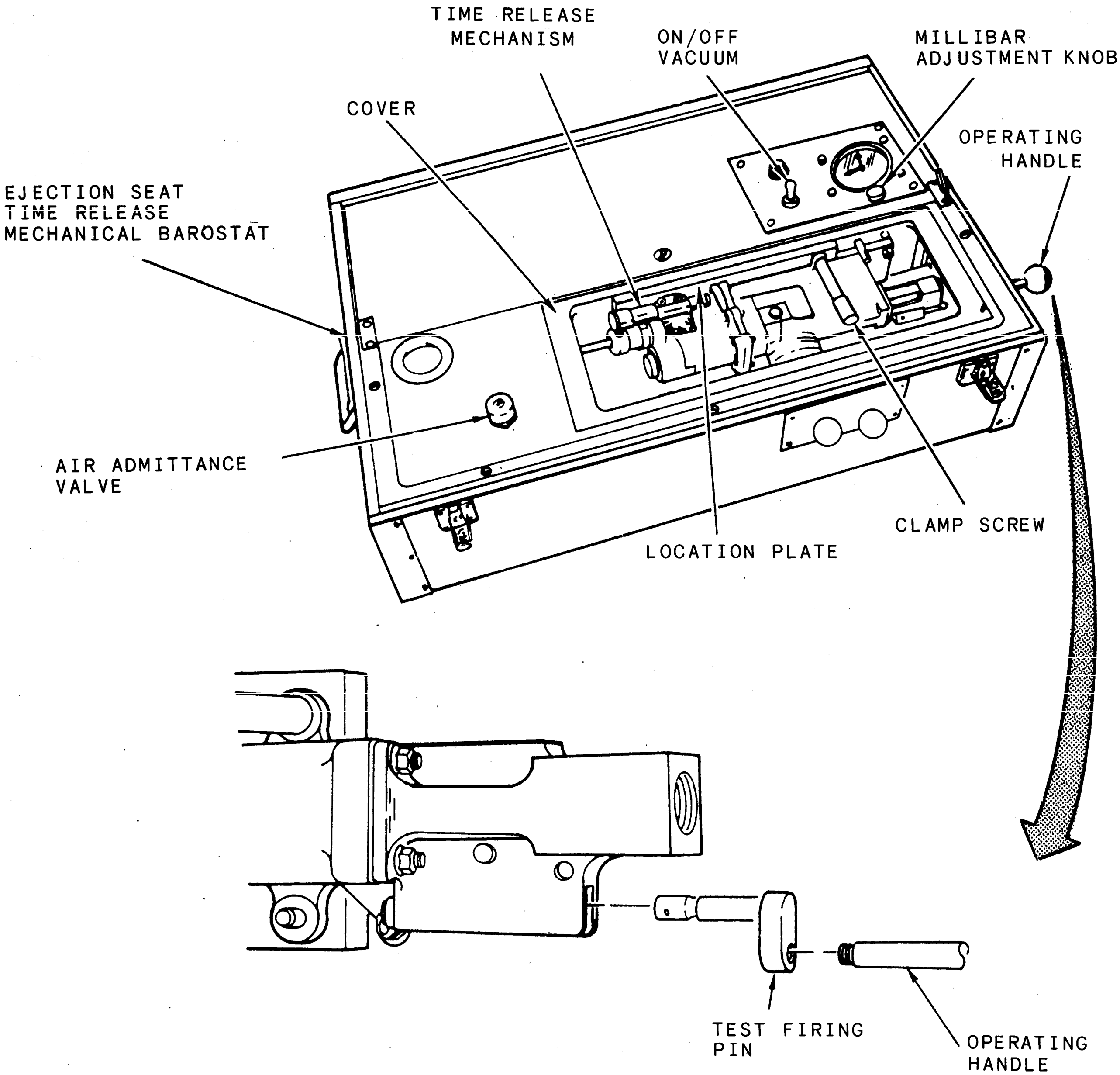


Figure 6-28.—Time-release mechanism barostat check-out.

14. Secure the test set and recock the TRM. Lockwire the firing link to the TRM and install the hex head plug and washer in the base of the TRM.

NOTE: QA should inspect the sear installa-tionand lockwire.

Other Tests

Other tests are required for this ejection seat. These tests are performed in strict compliance with the MRCs and MIMs. The steps requiring QA action are also very important.

All ejection seat parts and components received from supply must be checked or tested before being put into service. It is also recommended that ejection seats reinstalled on their mated ejection catapult guns.

Cannibalization of ejection system components must beheld to an absolute minimum. The swapping of components increases the possibility of maintenance error. Minimizing cannibalization should also decrease the possibility of logbook record error.

STENCEL SJU-8/A EJECTION SEAT

Learning Objective: Recognize the components, parachute and seat separation operations, seat subsystems, component maintenance, corrosion control, and lubrication and emergency cleaning procedures for the Stencil SJU-8/A ejection seat.

The Stencel SJU-8/A ejection seat is used in the A-7E aircraft. It uses thrust from a ballistic catapult and two seat-back rockets to propel it from the aircraft. (See figures 6-29, 6-30, and 6-31.) The seat provides escape capabilities during takeoff and landing emergencies from zero speed and zero altitude to speeds and altitudes of 600 knots and 50,000 feet. The system incorporates a seat-mounted, environmentally protected parachute, survival package with raft, emergency oxygen supply, and emergency locator beacon. The parachute is stored in a non-adjustable headrest. The front surface of the seat bucket provides a buffer for the calves of the legs, which are automatically restrained by straps to prevent flailing during ejection. The sides of the bucket extend upward and forward from the seat to protect the legs during canopy penetration.

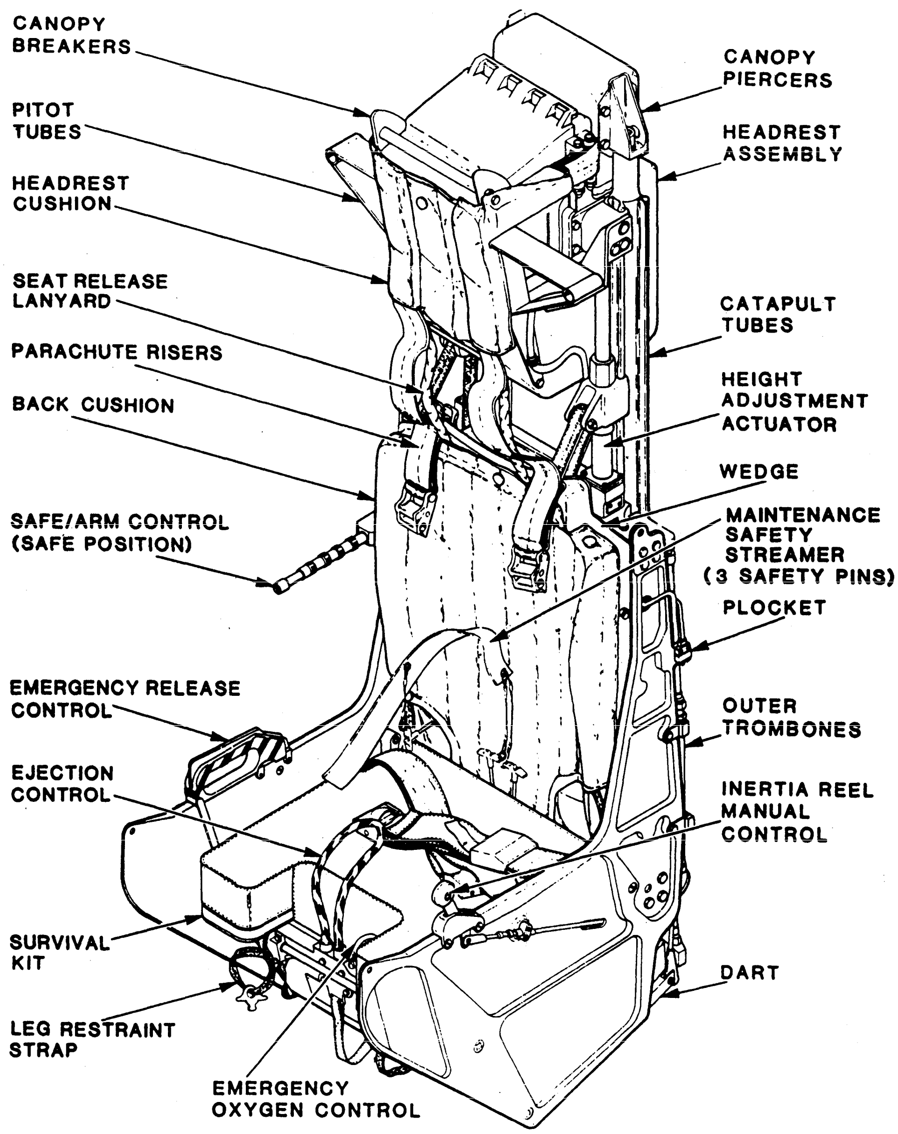


Figure 6-29.—SJU-8/A ejection seat assembly.

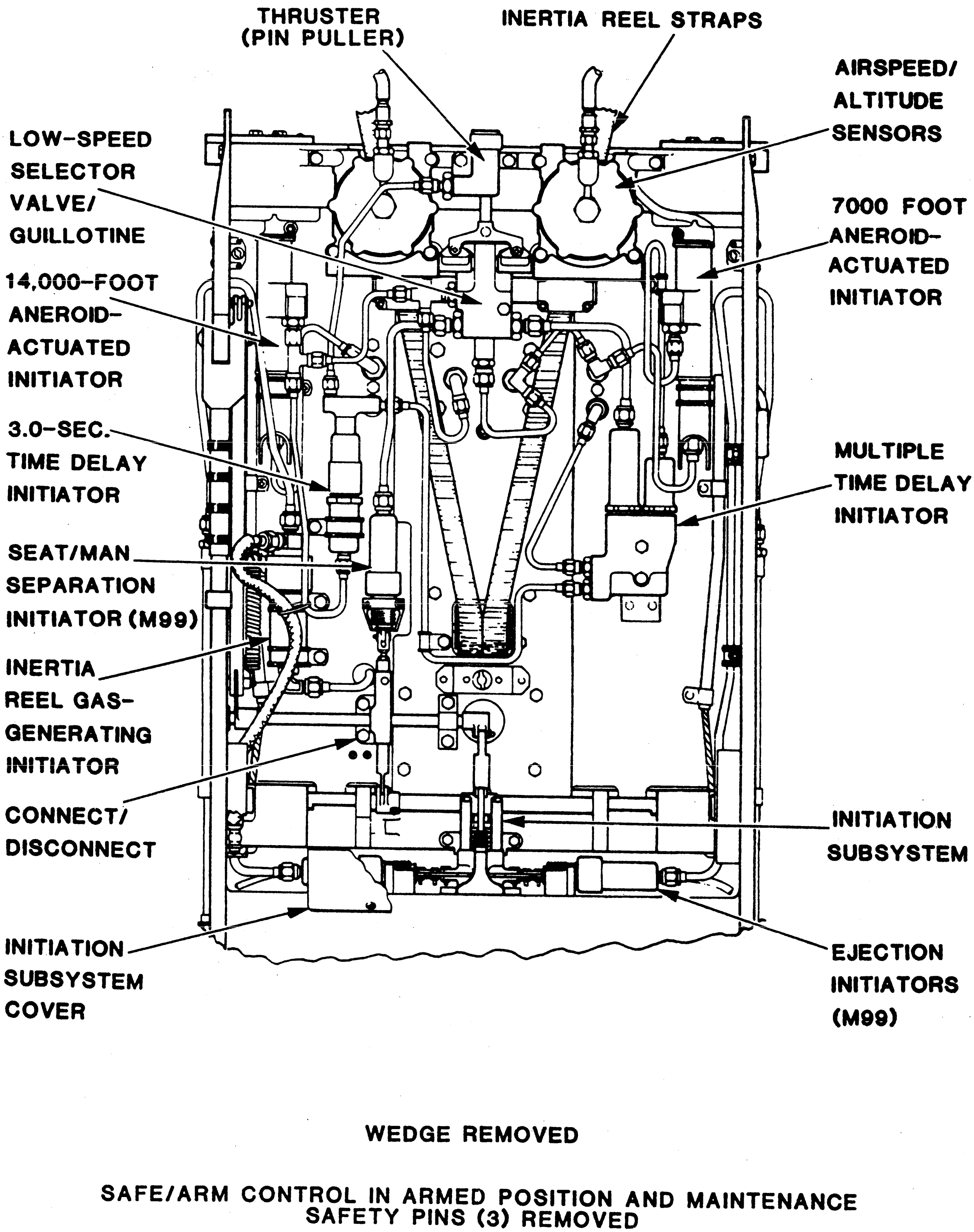


Figure 6-30.—SJU-8/A ejection seat assembly (front view).

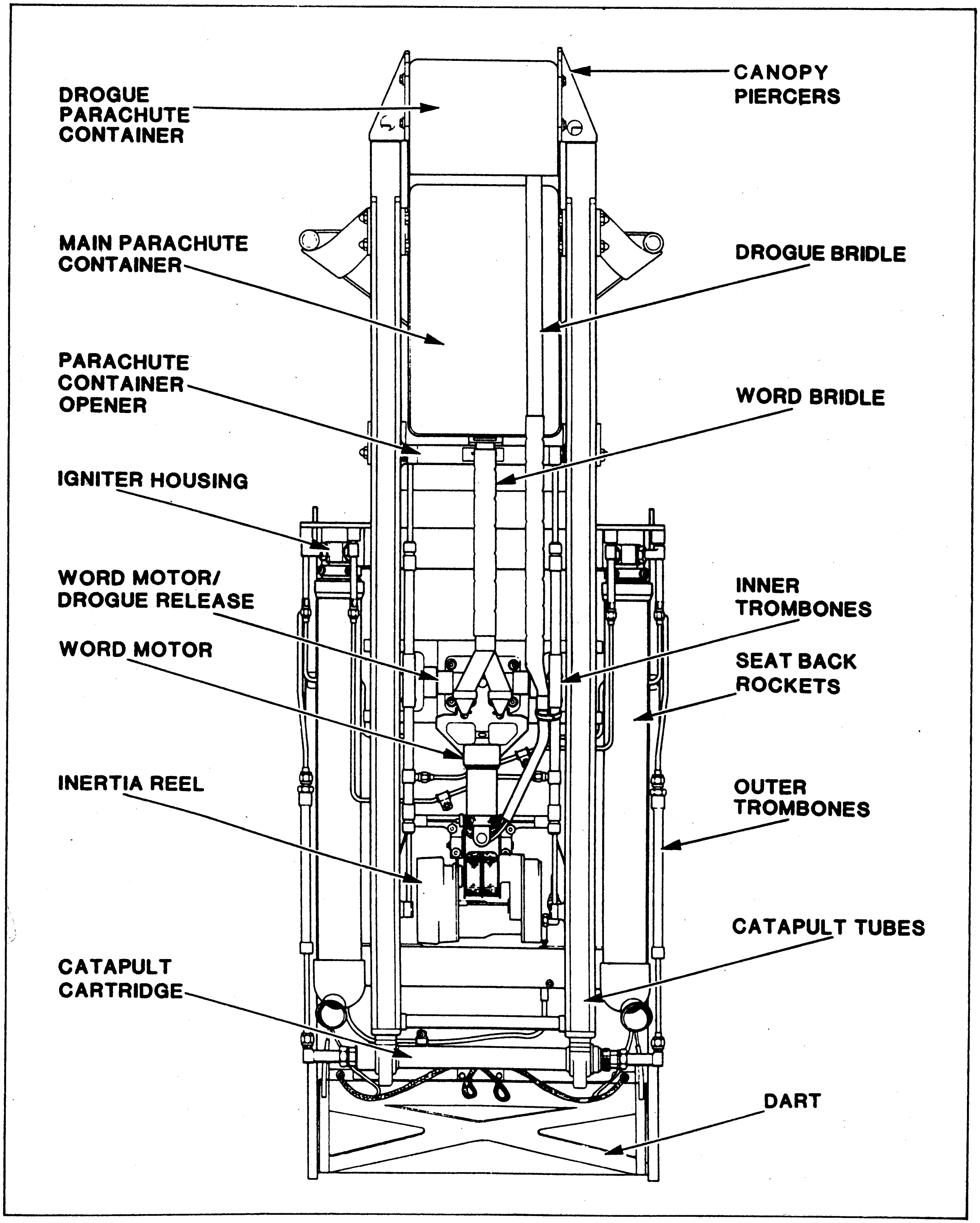


Figure 6-31..—SJU-8/A ejection seat assembly (back view).

The Stencel system has four modes of operation. As you read the material in the following paragraphs, carefully note the differences between these modes. The material describing the subsystems and components will amplify the modes of operation by explaining how and when each mode is activated. The remainder of this section will address the test equipment and test procedures used in the maintenance of the system.

SYSTEM OPERATION

The ejection sequence is initiated by pulling upward on the ejection control handle, which is located on the front panel of the seat bucket. Pulling the ejection control handle requires a force of 15 to 25 pounds through a distance of less than 4 inches. Pulling the control handle fires two M99 ejection initiators, which release hot, high-pressure gas to the ballistic signal transmission system (BSTS). Figure 6-32 is a schematic of the BSTS. The right M99 ejection initiator supplies gas pressure to the right side of the catapult cartridge igniter and the inertia reel gas-generating initiator. The left M99 ejection initiator supplies gas pressure to the left side of the catapult cartridge igniter, thereby

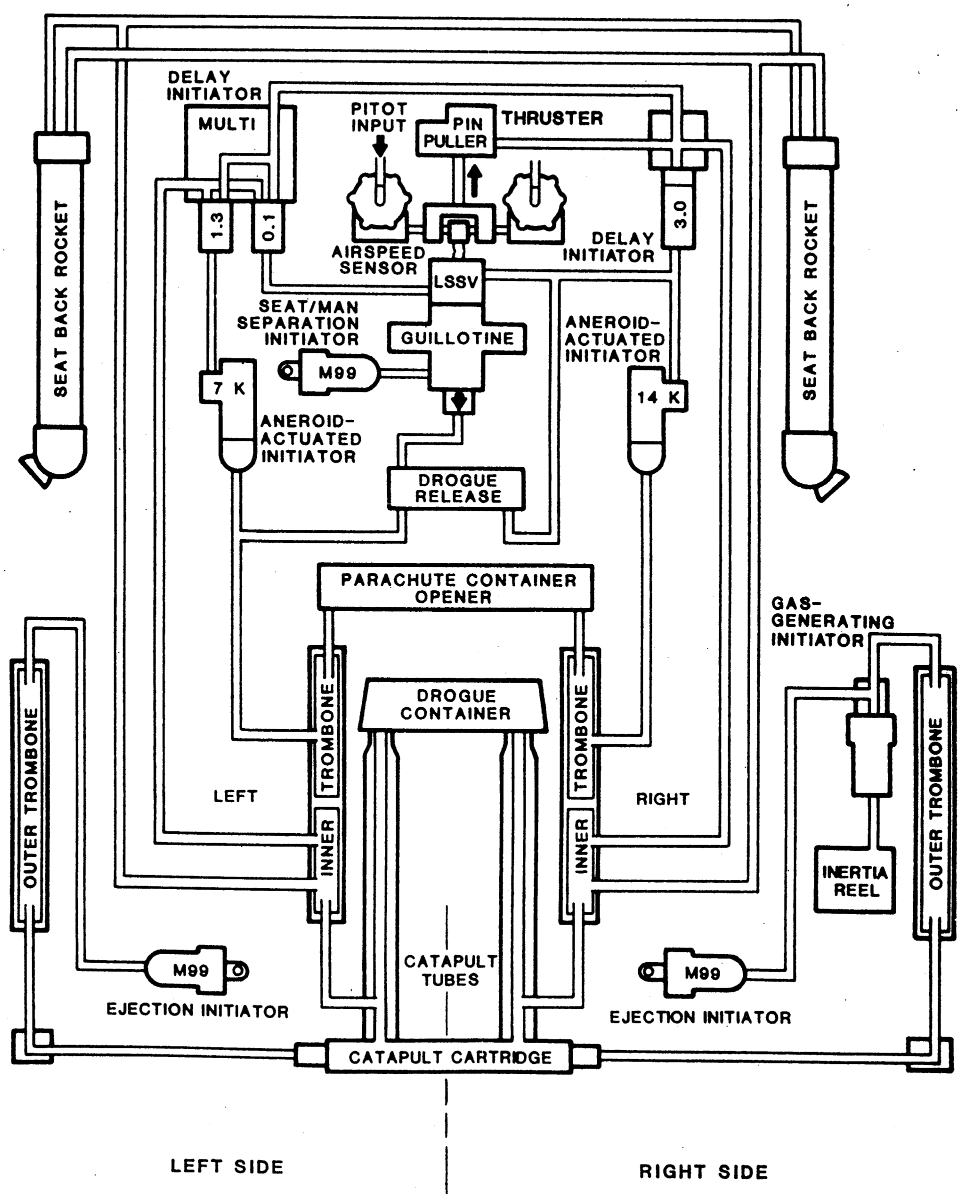


Figure 6-32.—SJU-8/A ballistic signal transmission system.

providing redundant ignition to the catapult cartridge.

As the seat catapult fires, the gas pressure forces locking pistons in the catapult tubes to disengage the locking balls, which unlock the inner and outer catapult tubes. As the seat and outer catapult tubes move upward, the pilot's legs are drawn against the front of the seat by the leg restraint mechanism. Simultaneously, the quick-disconnect fittings for pilot services are separated, and a lanyard on the catapult manifold activates the emergency oxygen bottle, IFF, and AN/URT-33 emergency radio beacon.

After approximately 16 inches of seat travel, gas pressure is applied to the drogue gun pistons housed in the catapult tubes. These pistons forcibly expel the drogue parachute container for quick drogue parachute deployment. The drogue parachute provides seat stability and aids in withdrawing the main parachute.

After approximately 31 inches of seat travel, gas pressure is ported to a thruster (pin puller), a 3-second time-delay initiator, a multiple time-delay (0.1- and 1.3-seconds) initiator, and the igniters of the two seat-back rocket (SBR) motors. The SBRs produce the thrust necessary for the seat and pilot to attain sufficient terrain and aircraft tail clearance to permit parachute deployment. The necessary thrust is available even at zero airspeed and zero altitude.

Upon ejection, the seat is stabilized by a Directional Automatic Realignment of Trajectory (DART) system. Two lanyards, attached to the aircraft and feeding through tension brake assemblies beneath the seat, counteract excessive pitch and roll.

The post-ejection sequencing system for deploying the Wind Oriented Rocket Deployment (WORD) motor and drogue release mechanism follows one of four automatic ejection modes, depending on the aircraft's airspeed and altitude. These modes of operation will be discussed later in this chapter. Depending on the mode of operation, the time-delay initiators fire, directing gas pressure to actuate the WORD motor and drogue release mechanism, and arm the aneroid-actuated initiator.

Upon actuation, the WORD motor/drogue release disconnects the WORD rocket motor. This allows the wind resistance on the drogue chute to withdraw the WORD motor from the seat. When the WORD rocket motor arming cable is withdrawn, it releases the firing pin and ignites the rocket. Depending on the mode of operation, the aneroid-actuated initiator fires. This activates the personnel parachute container opener, releasing the personnel parachute. The parachute will be withdrawn by either the WORD rocket motor, drogue parachute, or internal pilot chute.

When the personnel parachute suspension lines and risers become taut, a firing lanyard attached to a ballistic spreading gun extracts the spreading gun firing pin sear. The released firing pin strikes and activates a spreading-gun ballistic charge, which expels metal slugs in a 360-degree pattern. The slugs, attached to parachute suspension lines, rapidly inflate the canopy during very low-speed ejection. During high-speed ejection, the airstream energy far exceeds that of the spreading gun. Therefore, the gun has little effect on parachute inflation time.

As wind resistance acts on the personnel parachute, tension on the seat and man release lanyards actuates the seat and man separation initiator to produce gas pressure directed to the guillotine. The guillotine severs both inertia reel straps and releases the pilot's upper torso. Simultaneous actuation of seat and man separation mechanical linkage by the lanyards releases the survival kit assembly and pilot from the ejection seat.

The pilot may release the survival package in the survival kit by pulling a handle located near his right hip. After the package drops 12 feet, a snubbing lanyard initiates inflation of the life raft. The remainder of the survival package drops an additional 13 feet and hangs below the life raft to stabilize it during descent.

Ejection Mode Sequences

The Stencel seat is equipped with a mode sequencing system that controls four automatic ejection modes. The system includes a parachute container opener that is activated by gas pressure from the 7,000- or 14,000-foot aneroid initiators, or the seat and man separation initiator. The WORD rocket is also part of the system. The WORD rocket, mounted on the back of the seat, is connected to the drogue bridle assembly on one end and to the parachute WORD bridle on the other end. The WORD rocket motor is released from the seat and fired by a lanyard as it falls away from the seat during low-speed ejections or by the pull of the drogue during high-speed ejections.

The ejection sequence follows one of four modes, depending on aircraft airspeed and altitude. Mode 1 includes ejections where the aircraft is operating below 7,000 feet and at a speed less than 225 knots. Mode 2 includes an altitude below 7,000 feet, but at a speed greater than 225 knots. Mode 3 occurs above 7,000 feet, but below 14,000 feet, at any airspeed. Mode 4 occurs above 14,000 feet at any airspeed. Figure 6-33 presents a comparison of the various modes.

MODE I.— Mode 1 (fig. 6-34) is for a low-speed, low-altitude ejection. After the catapult outer tube assemblies have traveled upward a distance of approximately 31 inches, ballistic gases are ported through the inner trombone assemblies to actuate the 0.1- and 1.3-second time delays in the multiple delay initiator and the 3-second delay initiator. Gases from the 0.1-second delay actuate the drogue and WORD release and arm the 14,000-foot aneroid initiator. Below 14,000 feet, the initiator immediately actuates and gases pass through the right trombone to actuate the parachute container opener. Upon actuation of the WORD motor and drogue release assembly, the aerodynamic drag of the drogue parachute

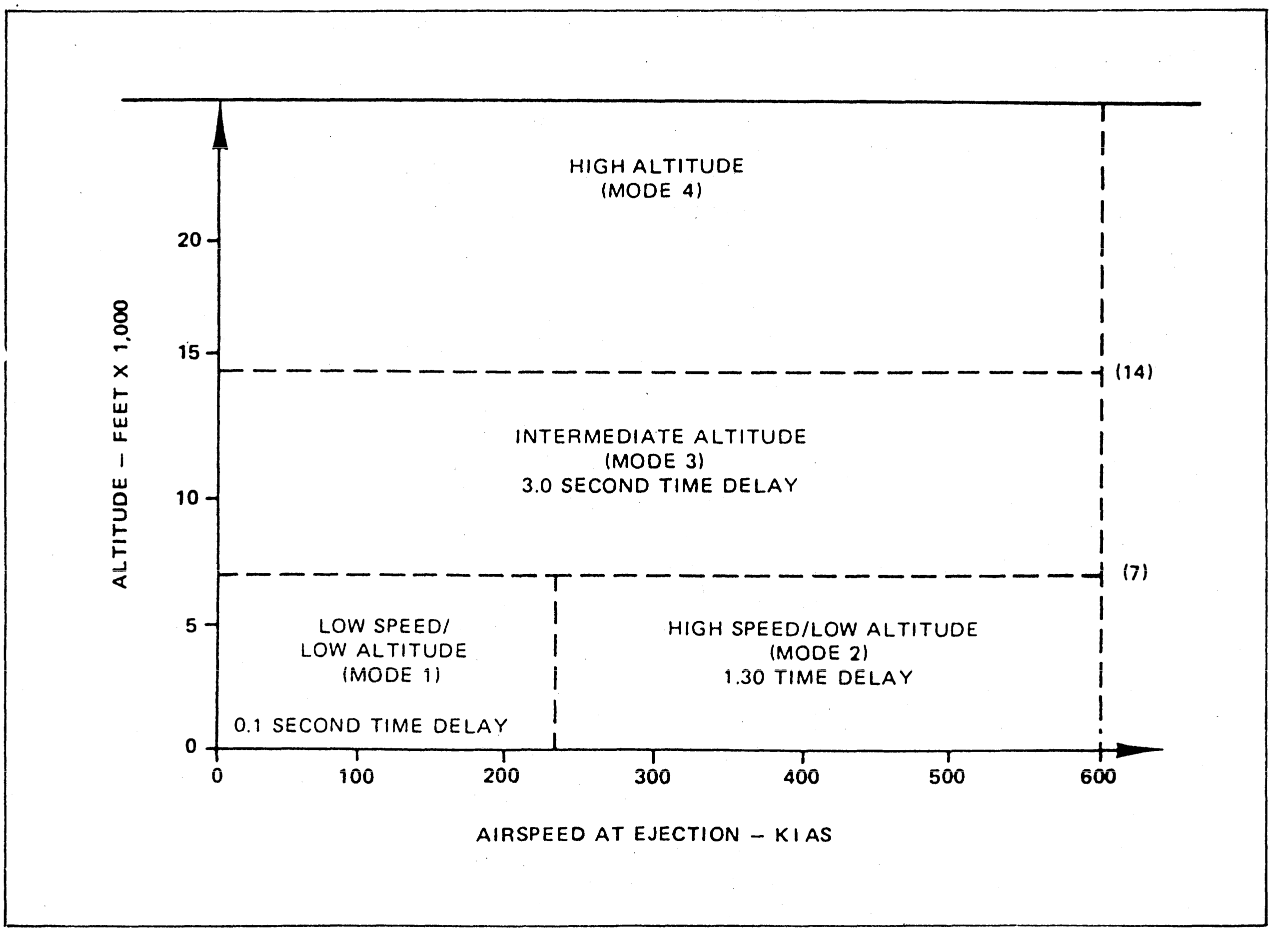


Figure 6-33.—SJU-8/A mode of operation.

pulls the WORD motor away from the seat back. This action extracts the firing lanyard from the motor and ignites the WORD motor.

When the WORD rocket is fired, it extracts the parachute from its container. The parachute drag pulls a lanyard that fires the ballistic spreading gun. The gun expels metal slugs, which are attached to alternate suspension lines on the parachute canopy skirt in a 360-degree pattern. This opens the parachute and allows the canopy to fill quickly. If the spreading gun fails to fire, a fail-safe collar releases the slugs and allows normal parachute inflation. If mode 1 fails, mode 2 will automatically provide the ejection sequence.

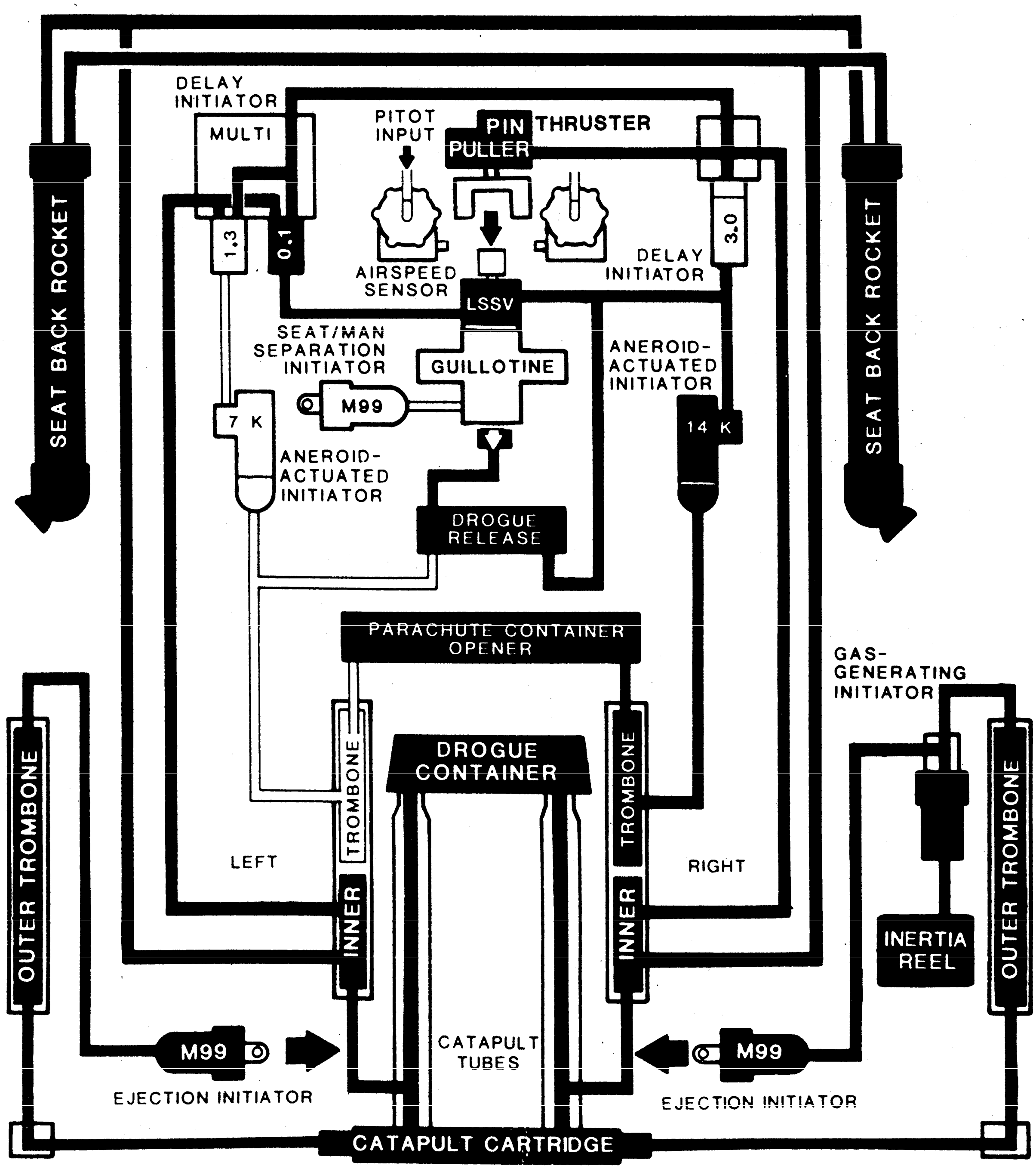


Figure 6-34.—Mode 1: low speed/low altitude.

MODE 2.— Mode 2 (fig. 6-35) is for a high-speed, low-altitude ejection. The primary initiation of the mode 2 sequence is identical to that of mode 1. To reduce parachute opening loads, the drogue decelerates and stabilizes the seat before the parachute opens. In mode 2, the output of the 0.1-second initiator is blocked by the low-speed selector valve (LSSV) because airspeed is above 225 knots. The flow of gases is delayed until the 1.3-second delay initiator fires. This delay reduces the parachute's opening shock. When the 1.3-second delay initiator fires, the ballistic gases are directed to the 7,000-foot aneroid-actuated initiator. Since the altitude is below 7,000 feet, the initiator fires. This actuates the WORD motor and drogue release assembly

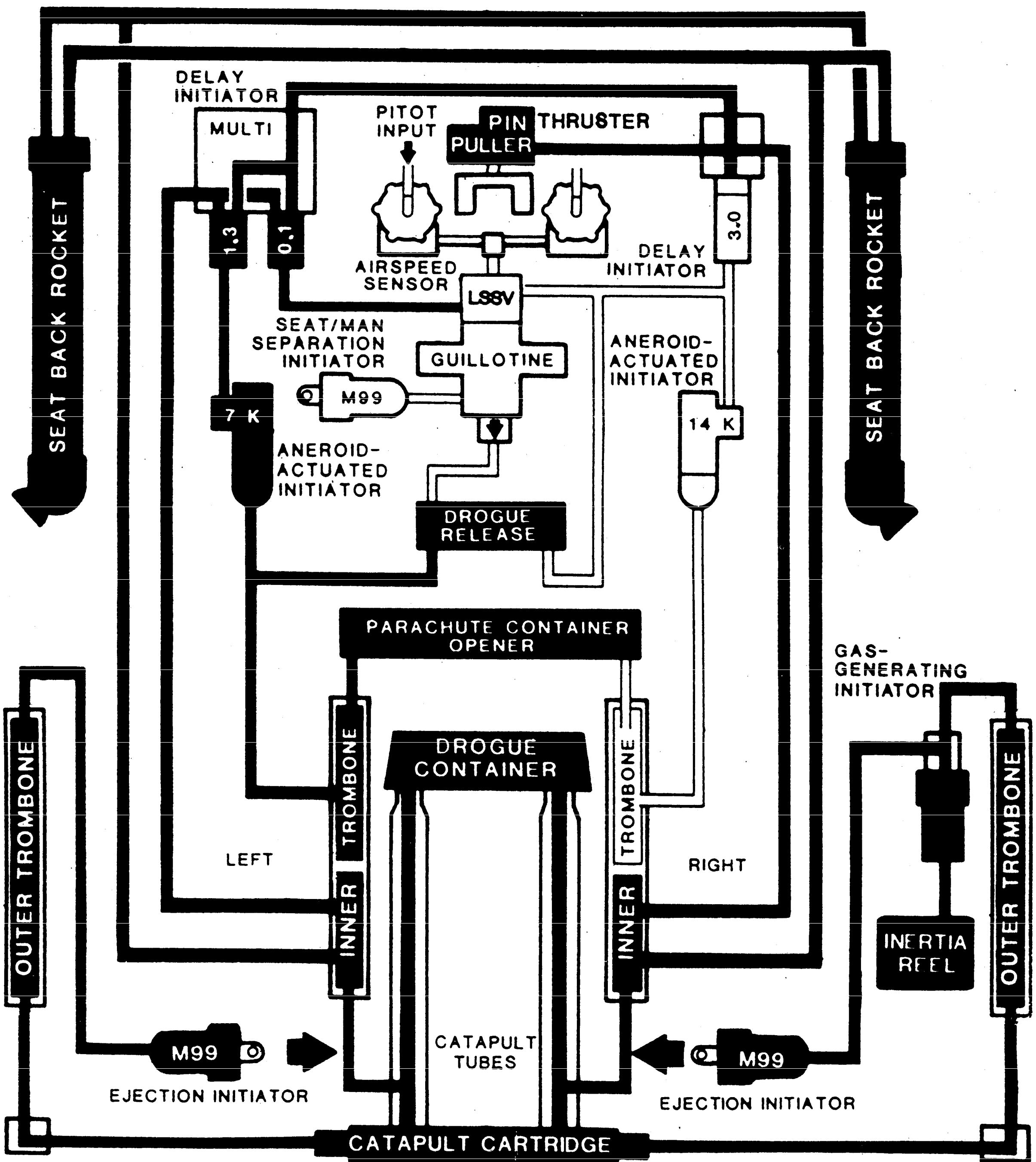


Figure 6-35.—Mode 2: high speed/low altitude.

and operates the parachute container opener assembly. The remainder of the mode 2 sequence is identical to the mode 1 sequence. If the mode 2 sequence should fail, then the mode 3 sequence automatically provides the ejection sequence.

MODE 3.— Mode 3 (fig. 6-36) is an intermediate altitude (above 7,000 feet and below 14,000 feet) ejection, which may occur at any airspeed. The primary initiation of the mode 3 sequence is identical to that of mode 1. At ejection, the airspeed and altitude sensors and low-speed selector valve (LSSV) block the gases from the 0.l-second delay initiator. The 1.3-second delay initiator fires and arms the 7,000-foot aneroid initiator, which is delayed

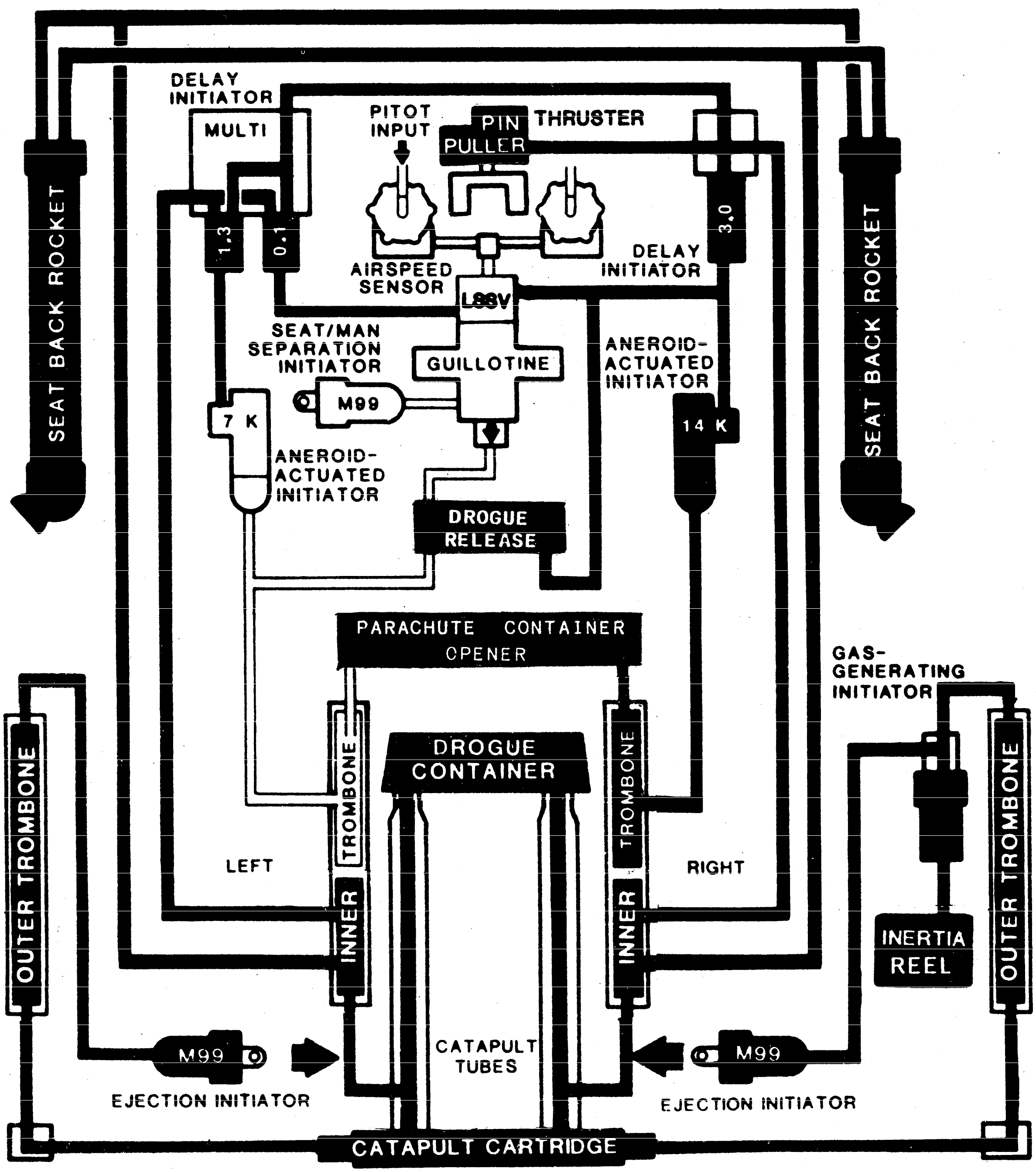


Figure 6-36.—Mode 3: intermediate altitude.

because ejection occurs above 7,000 feet. When the 3-second delay initiator fires, its gases actuate the drogue and WORD release and arm the 14,000-foot aneroid initiator. Since ejection occurs below 14,000 feet, the initiator fires immediately through the right trombone to operate the parachute container opener. The remainder of mode 3 is identical to mode 1. If mode 3 fails, then mode 4 automatically provides the ejection sequence.

MODE 4.— Mode 4 (fig. 6-37) is an ejection above 14,000 feet at any airspeed. The primary initiation of the mode 4 sequence is identical to that of mode 1. At ejection, the ballistic gases from the 3-second delay initiator actuate the

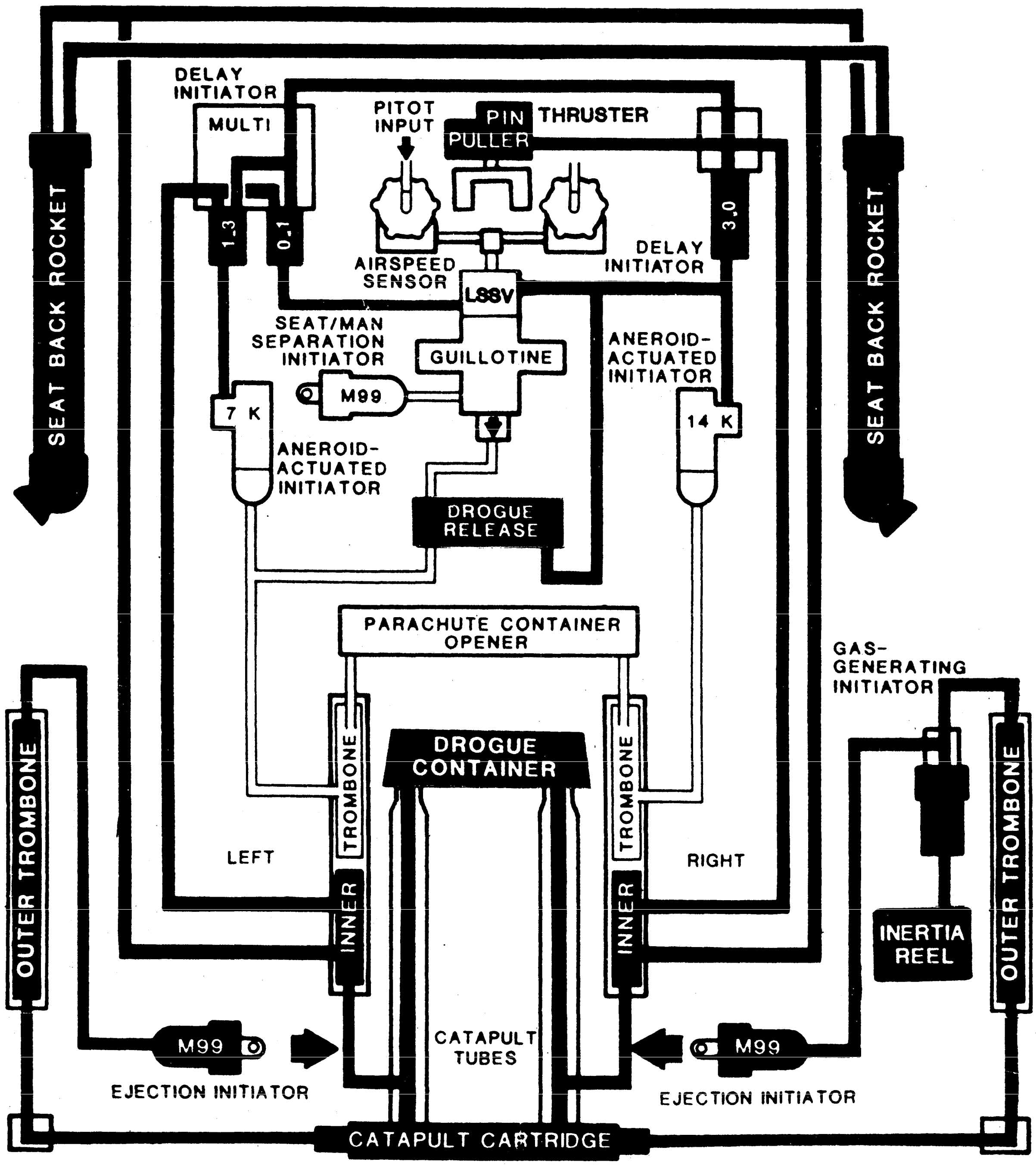


Figure 6-37.—Mode 4: high speed/high altitude.

WORD motor and drogue release assembly and arm the 14,000-foot aneroid-actuated initiator. Meanwhile, the 1.3-second delay initiator arms the 7,000-foot aneroid-actuated initiator, which acts as a backup. The seat and pilot, which are stabilized by the drogue parachute, descend to 14,000 feet pressure altitude. At that point, the 14,000-foot aneroid-actuated initiator fires, actuating the personnel parachute container opener assembly. The personnel parachute assembly is then deployed by the aerodynamic forces acting on the drogue parachute assembly.

Should either the 3-second delay initiator or the 14,000-foot aneroid-actuated initiator fail, the sequence would proceed as described above, except that free fall would continue to 7,000 feet pressure altitude. There, the 7,000-foot aneroid-actuated initiator would actuate the personnel parachute container opener assembly. The personnel parachute assembly would then be deployed by the drogue parachute assembly.

Emergency Parachute Operation and Seat Separation

If all automatic modes fail after the seat is ejected, the emergency release handle may be used for parachute deployment or seat and pilot separation. Operation of the emergency release handle overrides all automatic modes, but it should not normally be used above 14,000 feet.

Upon actuation, mechanical linkage fires the seat and man separation initiator directing ballistic gas to the inertia reel strap guillotine. The guillotine severs two straps and releases the pilot's upper torso restraint. Ballistic gas also actuates both the WORD motor and drogue release assembly and the parachute container opener assembly. The personnel parachute assembly is

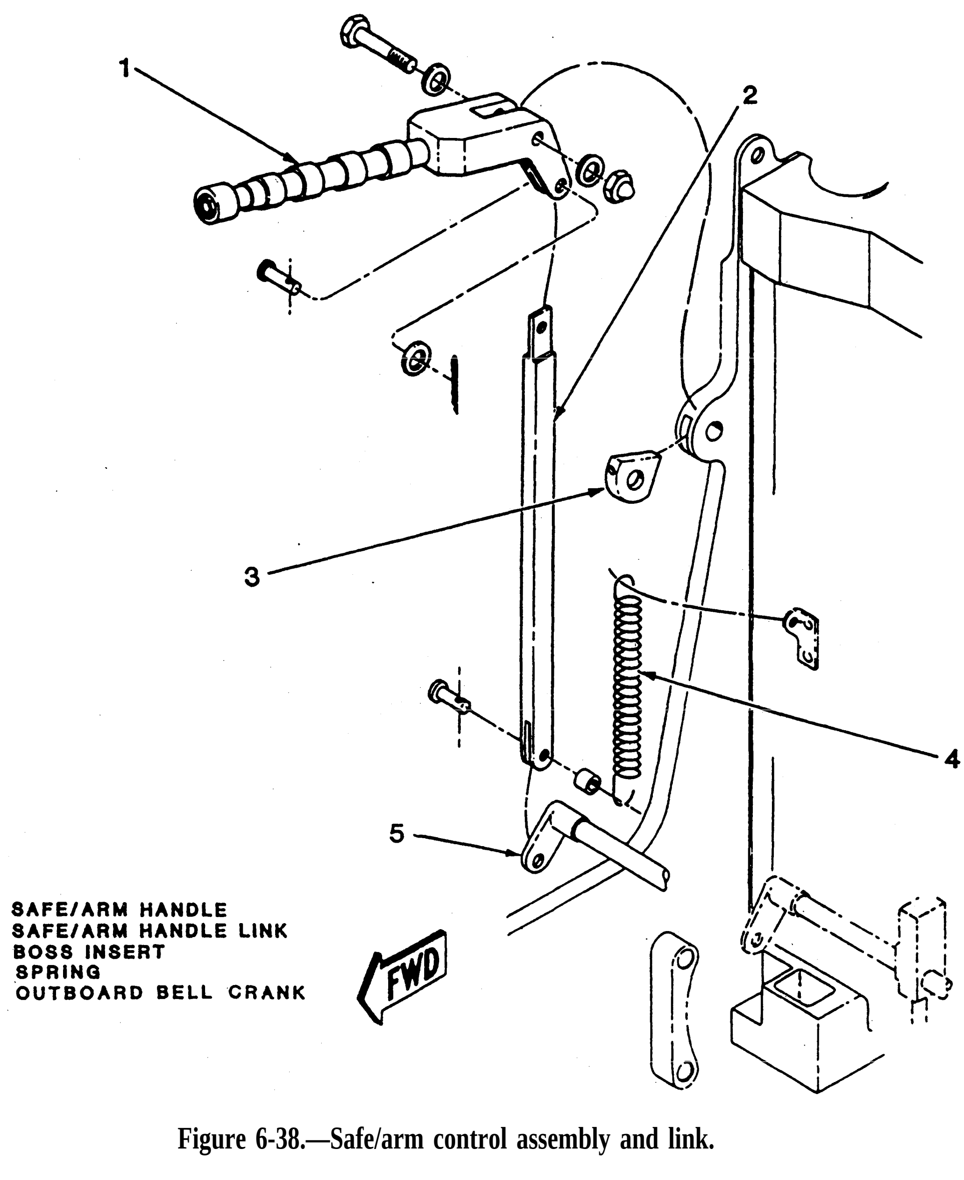


Figure 6-38.—Safe/arm control assembly and link.

then deployed by the drogue and the WORD motor, depending upon airspeed at the time of manual override initiation.

SUBSYSTEMS

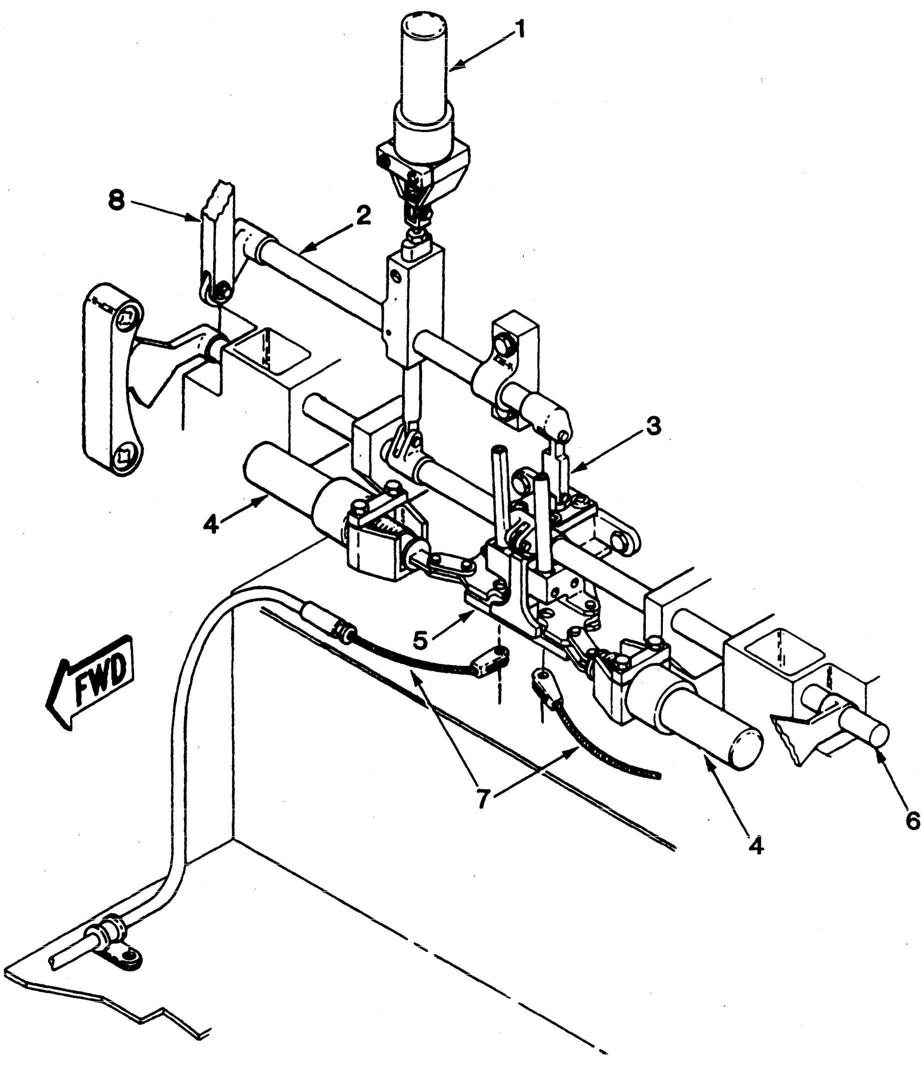
There are several functional subsystems of the Stencel SJU-8/A ejection seat. The subsystems are described in the approximate order in which they operate in the ejection sequence.

Safe/Arm Control Assembly and Link Subsystem

The safe/arm control assembly and link subsystem (fig. 6-38) places the seat in either a safe or an armed condition. The subsystem safeties three mechanically actuated M99 initiators when the seat is not occupied or when it needs to be kept in the safe condition. For the safe position, you should pull the knob on the handle to disengage the lock. Then move the handle to the full UP position. The seat is safetied by mechanically positioning a link and plunger, which prevents rotation of the initiation subsystem rotors. It also safeties the linkage that actuates the seat/man separation initiator. For the armed position, you should pull the knob on the handle and move the handle to the full DOWN position.

Ejection Initiation Subsystem

The ejection initiation subsystem (fig. 6-39) consists of an ejection control handle, mechanical



1. Seat/Man separation initiator
2. Connect/Disconnect assembly
3. Safety plunger
4. Ejection initiators
5. Initiator subsystem assembly
6. Seat release shaft
7. Ejection control handle cables
8. Safe/Arm handle link

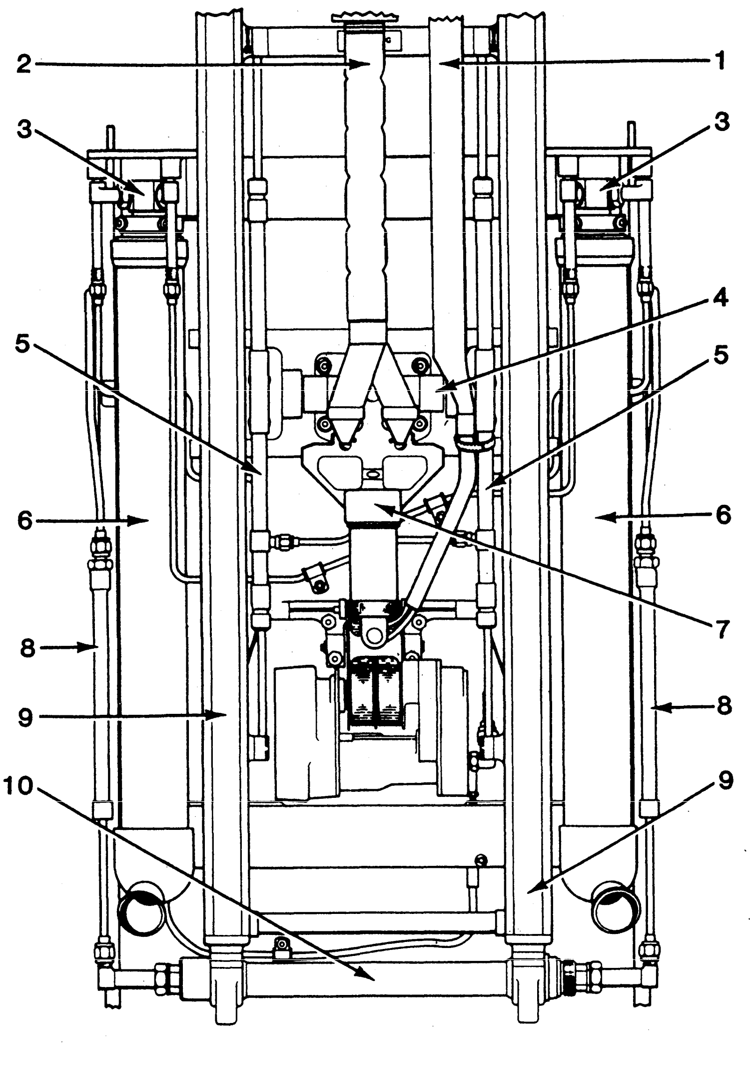
Figure 6-39.—Ejection initiation system.

linkage, and two ejection initiators. Actuation of the ejection control handle, located on the front panel of the seat bucket, mechanically pulls the firing cable, rotating the initiation subsystem rotors, which, in turn, extract a firing pin from each of the two M99 ejection initiators. The output gas pressure from either or both of the initiators is transmitted to two igniters, one on each side of the catapult cartridge, the inertia reel gas-generating initiator, the multiple time-delay initiator, and the thruster. The two catapult cartridge igniters provide catapult ignition redundancy.

Catapult Subsystem

The catapult subsystem (fig. 6-40) provides seat propulsion throughout the catapult stroke and applies pressure to the drogue pistons that project the drogue parachute and its container upward into the airstream. It also provides ballistic gas to initiate seat-back rocket ignition and post-election sequencing operations. This subsystem may be divided into five major parts. These parts are described in the following paragraphs.

CATAPULT CARTRIDGE.— The catapult cartridge provides ballistic gas pressure to boost



1. Drogue bridle
2. WORD bridle
3. Igniter housings
4. WORD motor/drogue release
5. Inner trombones
6. Seat-Back rockets
7. WORD motor
8. Outer trombones
9. Catapult tubes
10. Catapult cartridge

Figure 6-40.—Catapult system.

the seat and pilot out of the cockpit and to expel the drogue container and chute from the seat. The catapult cartridge also initiates ignition of two SBR motors and initiates the post-ejection sequencing subsystem (fig. 6-41).

CATAPULT TUBE ASSEMBLIES.— The catapult tube assemblies house the catapult lock and unlock mechanism, provide physical support for the seat bucket via the seat height adjustment actuator and slipper assemblies, and support the trombone assemblies. They also support a headrest and personnel parachute container assembly, drogue parachute and container assemblies, and associated interconnecting hardware.

The catapult tube assemblies also provide several other functions. First, they provide the energy and movement for the canopy piercers and breakers to penetrate the aircraft canopy. They also route and apply ballistic gas pressure to eject the drogue container and parachute. They route and apply ballistic gas pressure to initiate the seat-back rocket motors. Finally, they route and apply ballistic gas pressure to initiate the

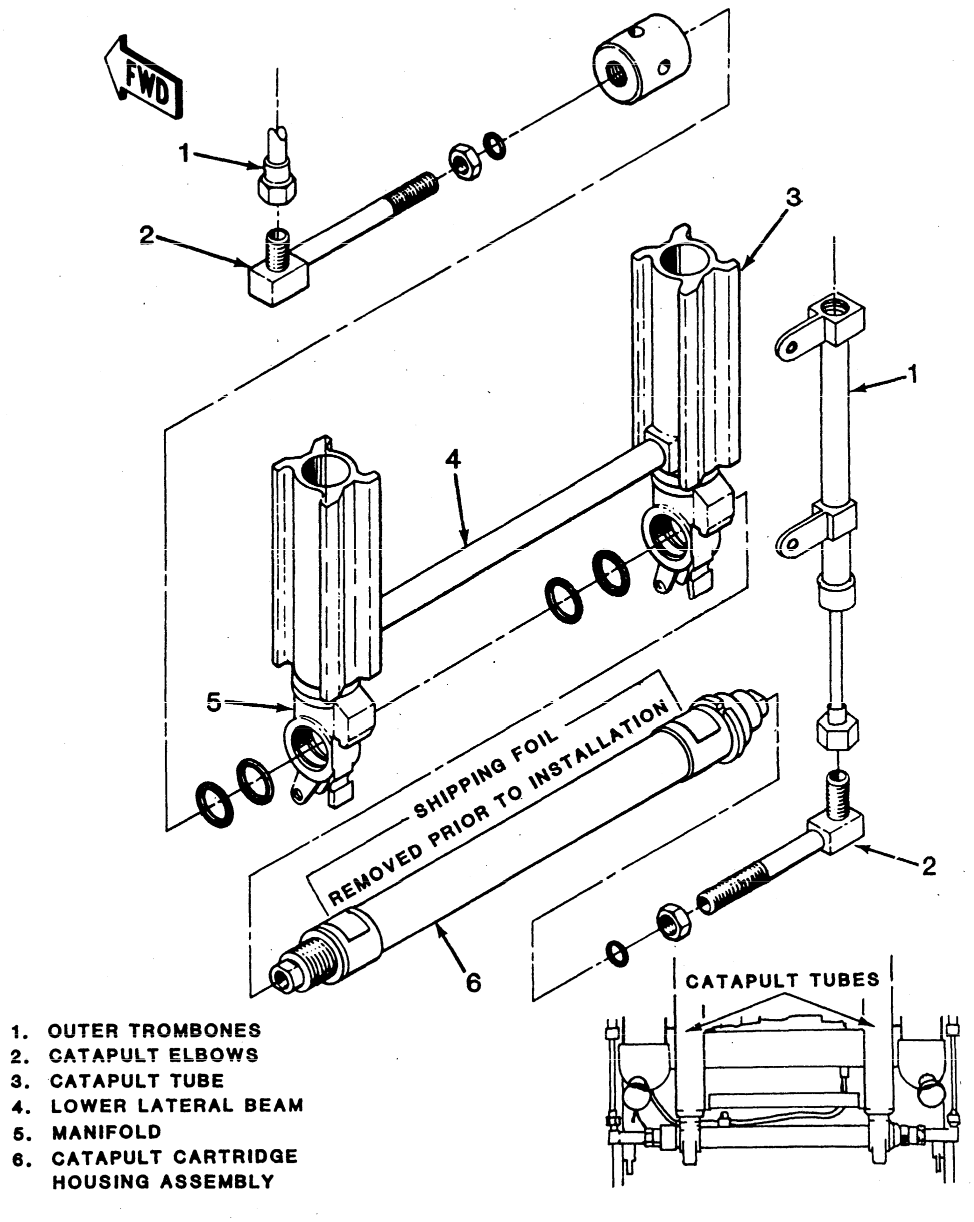


Figure 6-41.—Catapult cartridge and tube assemblies.

gas-operated components of the post-ejection sequencing subsystem (fig. 6-41).

CATAPULT LOCK AND UNLOCK MECHANISM.— The catapult lock consists of a locking piston and six locking balls set between the inner and outer catapult tubes. The catapult lock retains the seat in the cockpit during inverted flight. Upon seat ejection, the lock is released by gas pressure from the catapult cartridge. Catapult cartridge gases move the locking piston upward and permit the locking balls to disengage from the groove in the outer catapult tube. This action removes all connection between the inner and outer catapult tubes.

DROGUE CHUTE AND CONTAINER PROJECTION.— When the outer catapult tubes have moved upward approximately 16 inches on the inner tubes, gas pressure is applied to the pistons attached to the drogue container. There is one piston in each outer tube. When the pistons exit the top of the outer catapult tubes, the drogue container and parachute move up and aft of the seat. Then, aerodynamic pressure is applied to the container. This causes stretching of the drogue bridle and loosening of the drogue container flaps. The drogue suspension lines and canopy then emerge while the container and associated hardware are jettisoned (fig. 6-42).

TROMBONE ASSEMBLIES.— Two pairs of trombone assemblies are associated with the catapult. The outer trombone assemblies route ballistic gas from two M99 ejection initiators to the catapult cartridge igniters.

The inner trombone assemblies route ballistic gas pressure from the catapult tube assemblies to components of the post-ejection sequencing subsystems and to both seat-back rockets (SBR). They also route ballistic gas pressure from the 7,000- and 14,000-foot aneroid-actuated initiators to the parachute container opener (fig. 6-40).

Sustainer Thrust Subsystem

During either mode 1 or mode 2 operation, two SBR motors provide the thrust necessary to propel the seat and pilot to an altitude sufficient to attain terrain and aircraft tail clearance and to allow personnel parachute deployment and inflation. Each SBR has dual-ignition inlet ports. Ballistic gas pressure from both catapult tube assemblies is ported into both SBRs to provide redundant ignition. This pressure fires internal SBR igniters, which ignite the propellant grain for a burn time of approximately 0.25 second (fig. 6-40).

DART Stabilization Subsystem

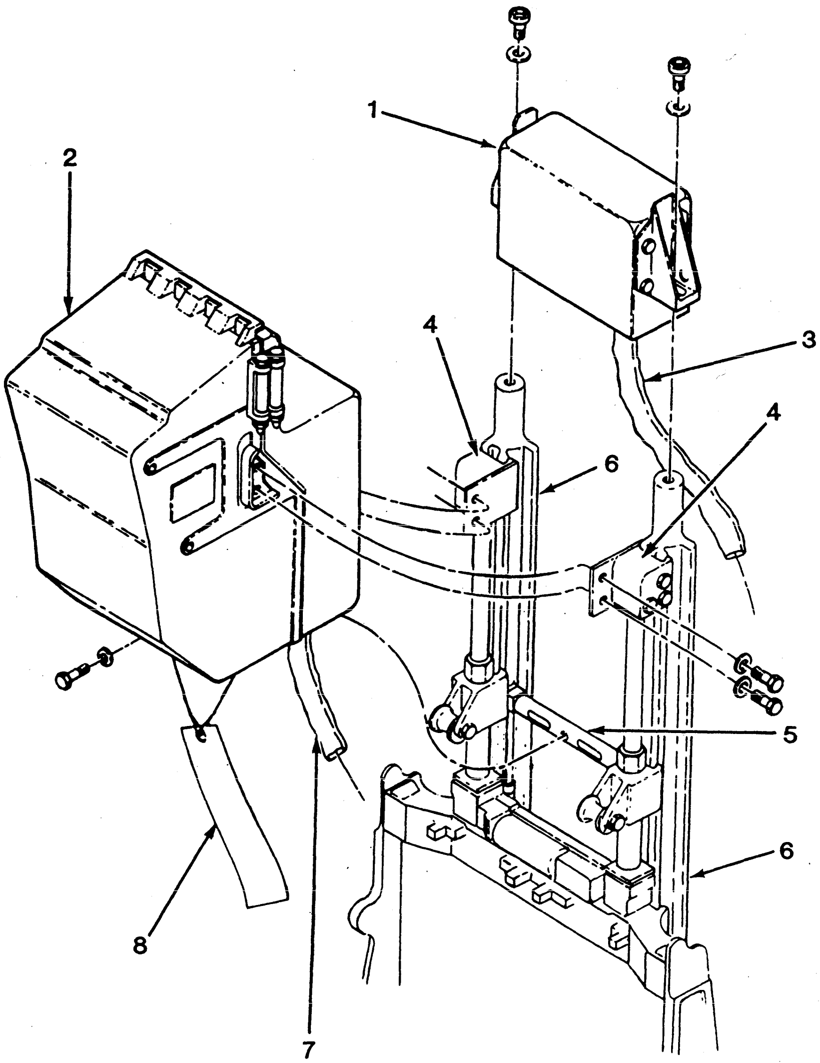
The directional automatic realignment of trajectory (DART) stabilization subsystem, composed of a bridle, a brake assembly, and two nylon slip lines, provides stabilization for the seat and pilot during low-speed ejections. Stabilization is accomplished by correcting any misalignment of the seat and pilot center of gravity relative to the SBR thrust center line. One end of the bridle is permanently attached to the under side of the seat bucket. It acts as a hinge during DART operation. Cables attached to the other end of the bridle restrict the arc of the bridle to a predetermined angle. This ensures optimum operation. Part of each slip line is stowed in a protective fabric housing routed through the brake assembly. The remainder of the two slip lines is stowed in a second protective fabric housing after being routed through fairleads on the bridle aft side. Free ends of the slip lines are attached to the catapult cartridge manifolds of the ejection seat. Slack in the slip line permits the seat to travel through seat tip-off and initial rotation, which results from center of gravity and thrust center line misalignment. Tension developed in the slip lines by the brake assembly imparts a correcting moment to the seat and pilot. This is necessary to counteract excessive seat and pilot pitch rotation and also to provide trajectory control.

Post-ejection Sequencing Subsystem

The post-ejection sequencing subsystem includes all gas-operated and cartridge-actuated devices required to initiate operational mode sequencing functions. It also includes the WORD rocket motor, the primary means for personnel parachute deployment in the inertia-WORD (I-WORD) rocket motor deployment sequence of mode 1, and the backup means for the drogue-WORD deployment sequence of modes 2, 3, and 4 .

Personnel Parachute Subsystem

The personnel parachute subsystem includes a WORD bridle assembly, riser assemblies with lanyards, spring-loaded internal pilot parachute assembly, main canopy assembly, ballistic spreading-gun assembly, and an override and



1. Drogue container assembly
2. Headrest assembly
3. Drogue bridle
4. Supports
5. Parachute container opener
6. Catapult tubes
7. WORD bridle
8. Headrest safety pin assembly

Figure 6-42.—Headrest and drogue container assemblies.

disconnect assembly. The riser assemblies with lanyards initiate the spreading gun and the seat and man separation.

When the parachute container opener is actuated, either one of the two locking clips will disengage and release a ball fitting on the end of a restraining cable. This action allows the container to open and the main canopy assembly to deploy. The canopy assembly is propelled by the WORD bridle, which is acted upon by the force of the drogue and WORD motor. Should the WORD bridle fail, the internal pilot parachute functions as a backup system.

When the main canopy and suspension lines are fully deployed, the spreading-gun firing lanyard exerts tension on a spring-loaded firing pin in the ballistic spreading-gun assembly. This pin is withdrawn until the pin-locking balls slip into a groove in the gun housing. Then, the firing pin, driven by spring force, releases, strikes, and fires dual primers that ignite the spreading gun cartridge. Cartridge energy drives 14 pistons (attached to alternate suspension lines), which expel 14 slugs in a 360-degree pattern and spread the main canopy. Should the spreading gun cartridge fail to fire, continued tension on the firing lanyard removes a piston-retaining band. This frees the slugs from the spreading-gun housing to allow conventional canopy inflation.

During main canopy deployment, tension is exerted on the pilot chute and main canopy by the WORD bridle. Also, during this time, the override and disconnect will secure the WORD bridle to the parachute. If there is no tension on the WORD bridle and the chute has over 10 pounds of drag, the override and disconnect will function to jettison the drogue chute, drogue bridle, WORD motor, and WORD bridle.

Seat/Man and Survival Kit Release Sequencing Subsystem

The seat/man and survival kit release sequencing subsystem has four functions. These functions are described in the following paragraphs.

AUTOMATIC RELEASE.— As the personnel parachute inflates during the ejection sequence, the parachute risers pull on the seat/man release lanyards. The lanyards rotate the seat pan release rod and fire the seat/man separation initiator. Gas pressure from the initiator then actuates the inertia reel strap guillotine. Gas is also transmitted to the WORD motor and drogue release assembly and parachute container opener, but these devices will have previously operated. Rotation of the seat release shaft releases the seat pan with the attached survival kit.

MANUAL OVERRIDE RELEASE.— The pilot can override any of the post-ejection sequences by actuating the emergency release control. When it is actuated, a mechanical linkage fires the seat and man separation initiator. This directs ballistic gas to the inertia reel strap guillotine, which severs the two straps. With the straps severed, the pilot's upper torso restraint is released. Ballistic gas also shuttles the WORD motor, drogue release assembly, and the parachute container opener assembly. The personnel parachute assembly is then deployed by the drogue or the WORD motor, depending upon the airspeed at the time of manual override initiation.

GROUND EMERGENCY EGRESS.— When the emergency release control is pulled, it rotates the seat release shaft and releases the seat pan with attached survival gear from the seat. The control also operates the linkage that fires the seat and man separation initiator. Initiator gases actuate the inertia reel strap guillotine, which severs the straps that are sewn to the personnel parachute risers. The pilot can then remove the shoulder harness, stand, and exit from the aircraft without parachute hang-up. As the pilot stands, the seat pan moves unrestrained and personnel service leads pull free from their connections. Also, activation of the seat/man separation initiator ballistically releases the WORD and drogue release and parachute container opener.

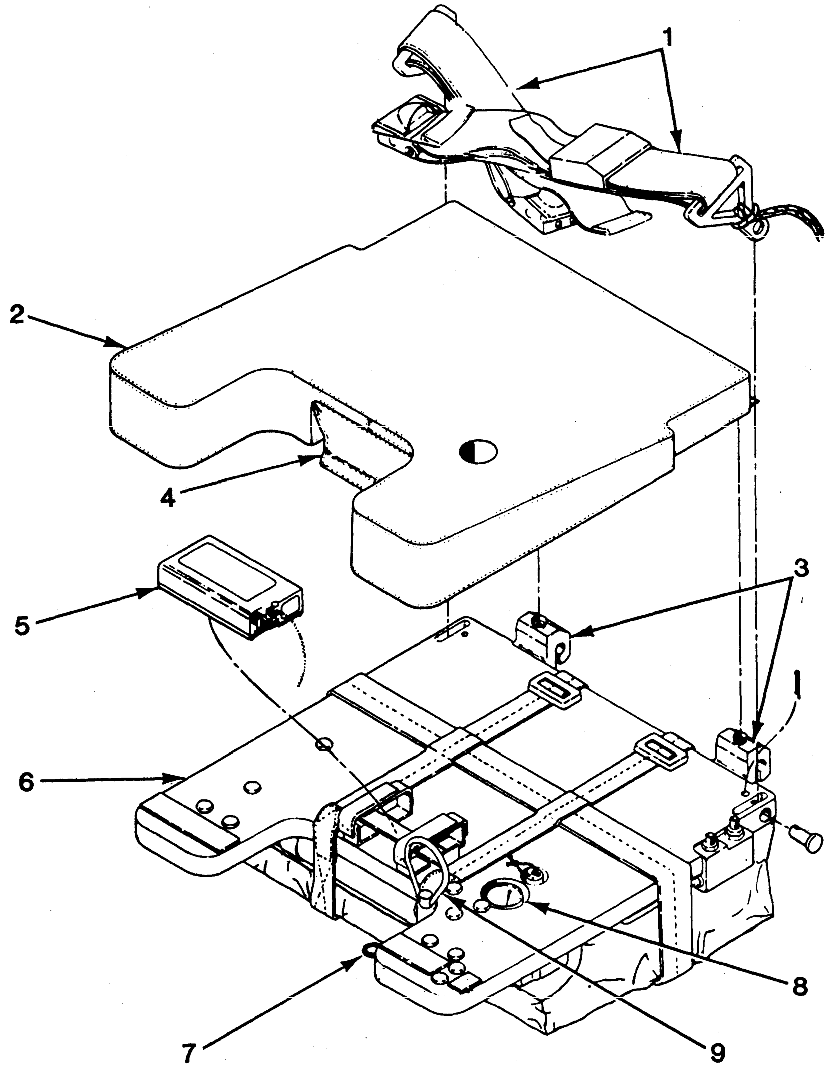
ROUTINE MAINTENANCE.— With the safe and arm control in the UP position and maintenance safety streamer safety pins installed, you must pull the emergency release control to remove the survival kit from the seat for replacement or maintenance.

Survival Kit

The survival kit (fig. 6-43) is a post-ejection life support unit that also serves as a structural portion of the ejection seat. There are three distinct components in the kit: the seat pan, survival package, and emergency oxygen supply.

The seat pan, constructed of a honeycomb core with aluminum alloy face sheets, performs a dual function. First, it provides a base for attaching post-ejection life support equipment. Secondly, as the pilots seat in the aircraft, it provides a structurally secure attachment for the pilot's lower torso restraint belts.

The survival package is attached to the seat pan through a lanyard system. This allows the package to fall free of the seat pan and still remain near the pilot. Upon manual release, the survival package falls approximately 12 feet. It is then snubbbed by a lanyard, which inflates the life raft. The package then falls 13 feet below the raft. This stabilizes the raft during parachute descent. The survival package contains a life raft,



1. Lap belt assembly
2. Bottom cushion assembly
3. Aft hooks
4. FOD flap
5. Radio beacon assembly
6. Survival package assembly
7. Emergency oxygen and personnel locator beacon lanyard
8. Emergency oxygen pressure gauge
9. Manual emergency oxygen control handle

Figure 6-43.—Survival kit assembly.

signal devices, medical aids, and miscellaneous survival aids.

The emergency oxygen supply, attached to the seat pan bottom, is a self-contained unit that can provide 50 cubic inches of breathing oxygen. It can be operated either automatically (during ejection) or manually. Automatic emergency oxygen control is provided by a lanyard assembly located on the underside of the seat pan left thigh support and is connected to the catapult cartridge manifold. During ejection, upward movement of the seat provides automatic actuation. Manual emergency oxygen control is provided by a handle and pull ring located on the inboard side of the seat pan left thigh support. An upward pull on the handle provides emergency oxygen to the pilot should the aircraft's main oxygen system fail. A pressure gauge, visible through a cutout on the forward left-hand side of the survival kit assembly, should indicate 1,800 psi (needle in the black area) with a full bottle. The emergency oxygen supply should last approximately 15 minutes, depending upon altitude and pilot demand. The higher the altitude, the shorter the duration, because oxygen is delivered by the mask regulator under pressure upon demand.

NOTE: Automatic actuation of the emergency oxygen supply also provides automatic actuation of the emergency locator beacon.

COMPONENT MAINTENANCE

Since the seat assembly is designed for “one-shot” operation, it cannot be operationally checked as a unit. However, various components that contribute to the successful functioning of the seat assembly must be operationally checked and tested.

It is your responsibility to check, test, and adjust ejection seat components as well as remove and replace cartridges. By using the applicable MIMs that contain the procedures for testing, adjusting, and checking components, along with diagrams, drawings, and trouble-shooting charts, you will be able to maintain the ejection seat properly and safely.

NOTE: The following material contains only typical maintenance practices and must not be used during actual component repair and tests. Use only the information contained in the applicable MIM.

There are several procedural checks that may be performed on the Stencel ejection seat. For each of these checks, you should ensure that the safe/arm control is in the SAFE (up and locked) position and that all three maintenance safety streamer safety pins are installed prior to beginning the tests. Most of the checks require that you remove the survival kit and wedge assemblies prior to starting the test and reinstall them at the completion of the test. This is not required for the height adjustment actuator check-out. When you are performing several checks in succession, you do not need to remove and reinstall the survival kit and wedge assemblies between each test.

Safe/Arm Control Assembly Check-out

The individual actions required to check-out the safe/arm control assembly may be grouped’ into 11 major steps.

1. Install the initiator pull test tool set, as shown in figure 6-44.

2. Manually release the safe/arm control assembly release. You should ensure that spring tension is evident in the release knob. Then, you should lower the safe/arm control to the full DOWN position.

3. Attach a push-pull gauge to the safe/arm control assembly and then pull upward. The handle should move upward and lock in the SAFE (full up) position with a maximum force of 10 pounds with no evidence of binding. You should observe the outboard bell crank rotate downward, disengaging the upper and lower connect and disconnect sears. Also observe that the inboard bell crank rotates upward to fully engage, the safety plunger between the initiator rotors.

4. Raise the emergency release handle to the UP and LOCKED position. You should not see movement of the upper connect and disconnect sear; however, the lower connect and disconnect sear should move down. You should check to see that the T-bar blocks the initiation rotors.

5. Lower the emergency release handle to the full DOWN position: You should see the bell crank connected to the lower sear rotating up-ward, the initiation subsystem rotors not moving, and the T-bar moving, down.

6. Observe that the initiation rotors do not move when you pull on the ejection control handle.

7. Lower the safe/arm control assembly to the full DOWN position. You should ensure the safe/arm control moves to the DOWN position with no evidence of binding, and the inboard bell crank moves downward and completely disengages the safety plunger from the rotors.

8. Raise the safe/arm control assembly to the full UP position. You should ensure that the safe/arm control is locked into position.

9. Lower the safe/arm control assembly to the full DOWN position. The emergency release handle is raised to the UP and LOCKED position. You should observe that the upper sear moves down and the pull-test tool extends to the RELAXED position.

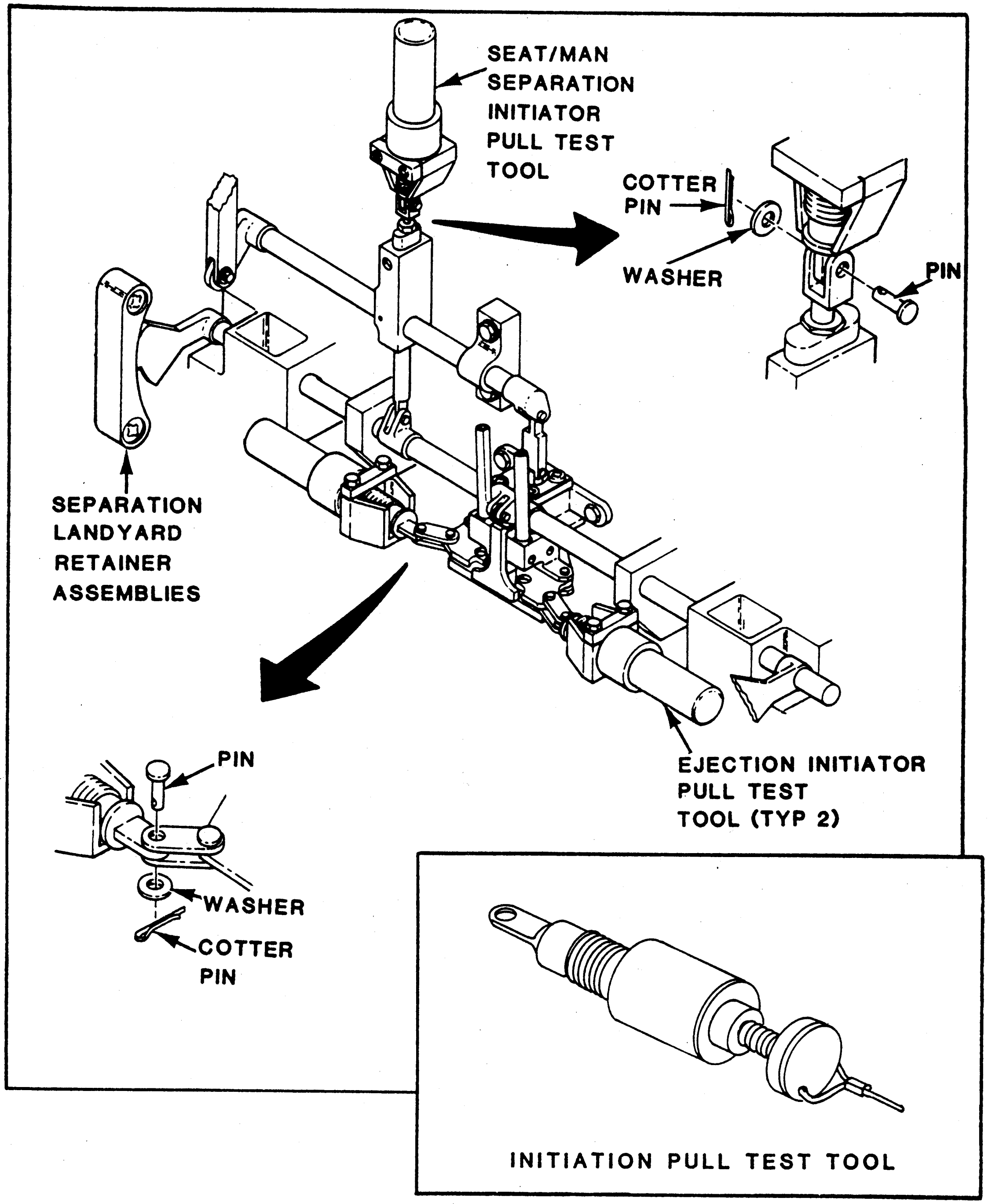


Figure 6-44.—Initiation pull-test tools installation.

10. Lower the emergency release handle to the DOWN and LOCKED position. When you pull up on the ejection control handle, you can observe that the initiation rotors move and the pull-test tool extends to the relaxed position.

11. Stow the ejection control and reset the pull-test tools. You should raise the safe/arm control to the full UP position. Then, you remove the initiation pull-test tool set.

Emergency Release Handle Assembly Check-Out

The emergency release handle assembly check-out may be divided into nine major steps.

Portions of the test are shown in figures 6-45 and 6-46.

1. Install the initiation pull-test tool set. Lower the emergency release handle and the safe/arm control to the DOWN and LOCKED position. Position the push-pull gauge against the top of the emergency release handle and press down on the latch. You should be able to retract the latch with a maximum of 15 pounds of force.

2. Depress the locking latch and raise the emergency release handle one-fourth inch. Attach a push-pull gauge and lanyard to the emergency release handle and pull up and aft. The handle should rotate fully with a maximum force of 40 pounds. You should also notice that seat release shaft rotation actuates the seat and man separation sear, and the pull-test tool extends to the relaxed position. Check to see that the T-bar blocks the firing control rotors, and the emergency release handle is locked in the UP position.

3. Lower the emergency release handle to the full DOWN and LOCKED position. Watch the seat and man separation sear return to the ARM position and the T-bar disengage from the firing control rotors.

4. Raise the safe/arm control to the full UP and LOCKED position. Squeeze the emergency release handle and slowly pull up and aft. Notice that the connect and disconnect upper sear does not move. Lower the emergency release handle to the full DOWN and LOCKED position.

5. Grasp the emergency release handle and, without squeezing the handle or releasing the locking latch, pull up on the handle. The handle should not move.

6. Remove the clevis from the fork at the connect and disconnect sear. Remove the top screws and loosen the bottom screws on the lanyard retainer assemblies. Rotate the retainers forward.

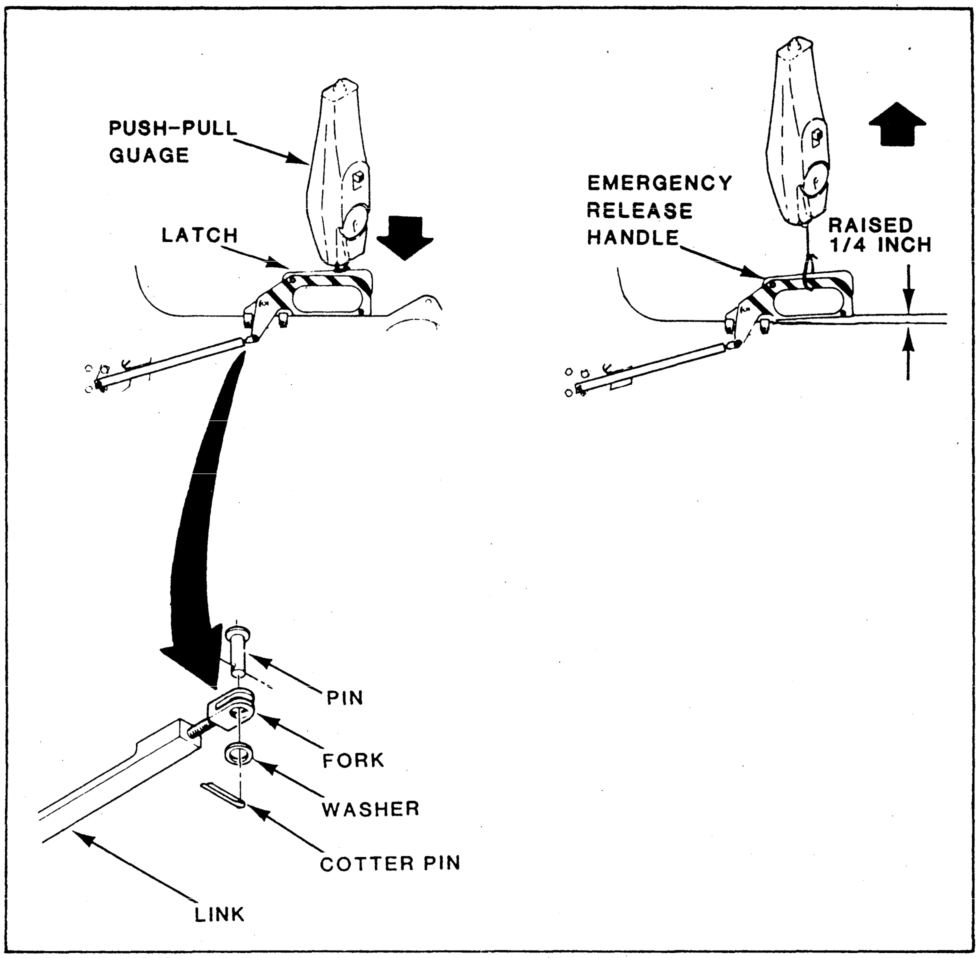


Figure 6-45.—Emergency release handle assembly check-out.

7. Lower the safe/arm control to the DOWN and LOCKED position. Simulate a seat/man separation by unlocking the emergency release handle. Pull upon both the seat and man separation lanyards. Observe that the seat release shaft rotates to the released position and the seat/man separation upper sear moves downward. You should also notice that the seat/man separation lanyards release from the bell cranks.

8. Attach the seat release lanyards to the seat release lanyard bell cranks. At this point, make sure that the seat release lanyards are not pinched between the seat release lanyard bell cranks and the slots in the lanyard retainer assemblies. Rotate the seat release lanyard bell cranks down below the shear pins in the lanyard retainer assemblies. You should ensure that the lanyards remain attached to the bell cranks. Rotate the lanyard retainer assemblies up and aft and install the top screws and washers. Tighten the bottom screws in the lanyard assemblies. When you apply light hand pressure, you should observe freedom of movement in the bell cranks.

9. Lower the emergency release handle to the DOWN and LOCKED position. Remove the initiation pull-test tool set.

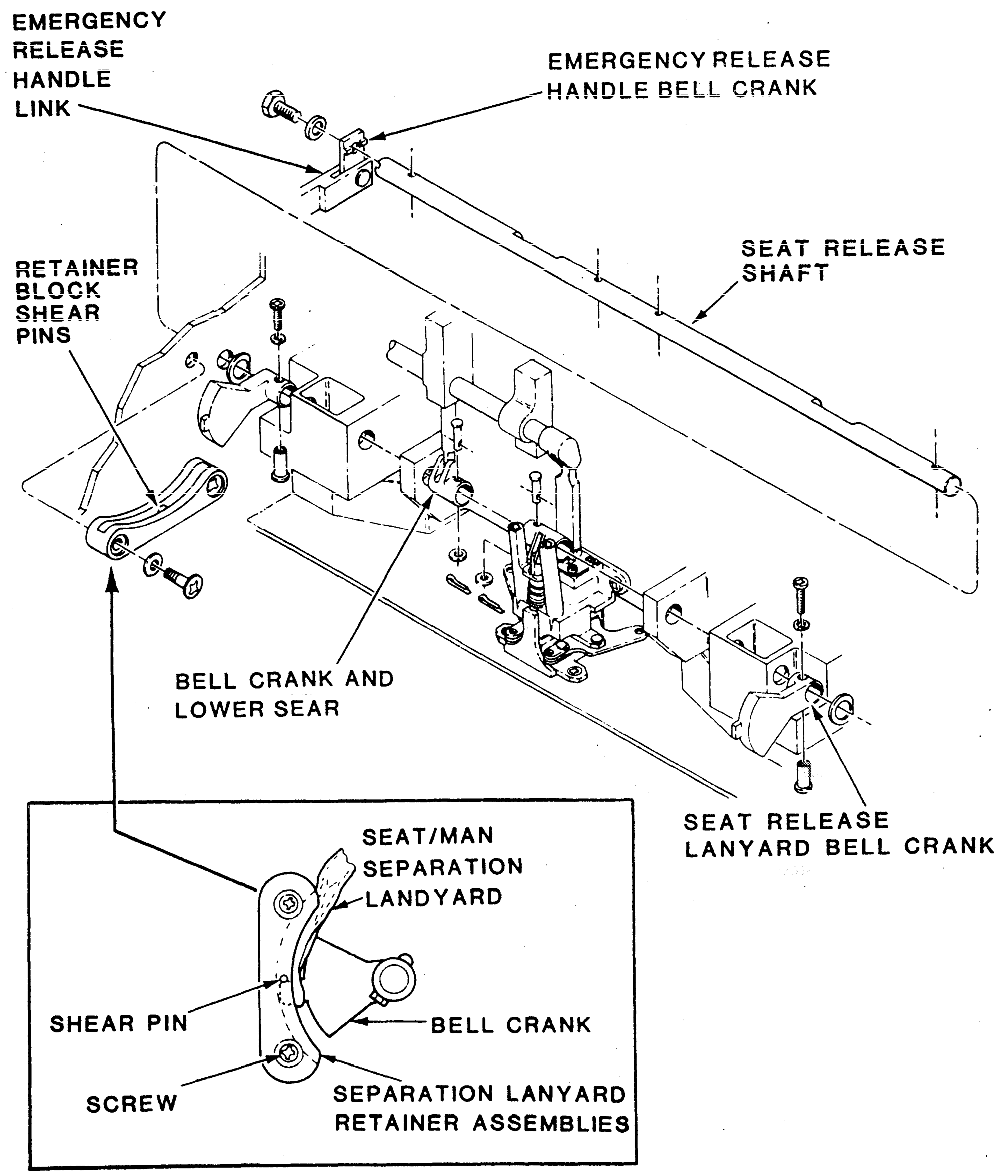


Figure 6-46.—Separation lanyard retainer assemblies.

Ejection Control Assembly Check-out

Checking the ejection control assembly is a four part procedure. The first part of the procedures shown in figure 6-47.

1. Install the initiation pull-test tool set. Ensure the ejection initiator pull-test tools are not preloaded. Position the safe/arm control to the full UP position. Attach a push-pull gauge to the ejection control assembly. Pull upward and record the breakout force. The breakout force should be 15 to 25 pounds.
2. Lower the safe/arm control to the full DOWN position. Continue pulling upward on the ejection control assembly until the pull-test tools extend to the relaxed position. The force required to accomplish this task should be 15 to 40 pounds. You should ensure that the ejection control assembly does not separate from the seat. You should also observe the initiation rotors rotating past the safety plunger.
3. Stow the ejection control assembly while manually returning the initiation subsystem rotors to the ARMED position. Then install the initiation pull-test tool to the upper connect and disconnect sear. At this point you can simulate automatic seat/man separation by rotating the emergency release handle to the full UP position. Notice that the upper connect and disconnect sear moves down, and the pull-test tool extends to the relaxed position. Check to see that the T-bar is in the full UP position, and that it is blocking the initiation rotors.
4. Raise the safe/arm control to the UP and LOCKED position. Lower the emergency release handle to the DOWN and LOCKED position. Remove the initiation pull-test tool set.

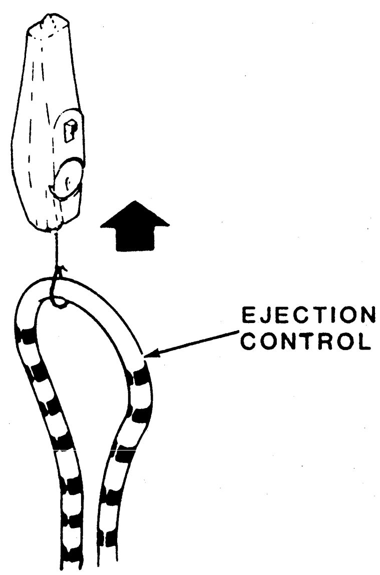


Figure 6-47.—Ejection control assembly check-out.

Inertia Reel Assembly Check-out

The inertia reel check-out may be grouped into seven steps. The test is shown in figure 6-48.

1. Insert the bridle rod through both the parachute riser loops. Position the inertia reel manual control to UNLOCK. Then grasp the center of the bridle rod and extend the risers to mid position. Hold the risers extended and position the inertia reel manual control lever to LOCK. When you pull firmly on the center of the bridle rod, the risers should not extend.
2. Slowly allow the risers to retract. The risers retracting and ratcheting action should be audible during retraction. The inertia reel control lever should not snap into position, or the test results will not be valid.
3. Slowly position the inertia reel manual control lever to UNLOCK. Grasp the center of the bridle rod and extend both risers to the mid position. Exert a sharp pull on the bridle rod. The inertia reel should lock and the risers should not extend when a firm pull is applied. Slowly allow the risers to fully retract, and then pull the risers again. You should not be able to extend the risers.
4. Position the lever to LOCK, and then UNLOCK and extend and retract the risers. The risers should extend and retract freely.
5. Attach a push-pull gauge to the bridle rod. Pull the gauge straight and extend the risers. You should record the force required to extend them. Repeat the step three to five times. The risers should extend with a force of 5 to 15 pounds. Allow the riser to retract slowly.
6. Position a 24-inch steel rule against the forward edge of the yoke and perpendicular to the catapult tubes. Without extending the inertia reel straps, lift the bridle rod and measure the normal extension of the risers. You should record this measurement. Pull on the bridle rod and measure the full extension of the risers. Again, record the measurement. Allow the risers to retract slowly. At full extension, you should observe a minimum of 18 inches. Then, subtract the normal measurement from the extended measurement. The difference between the

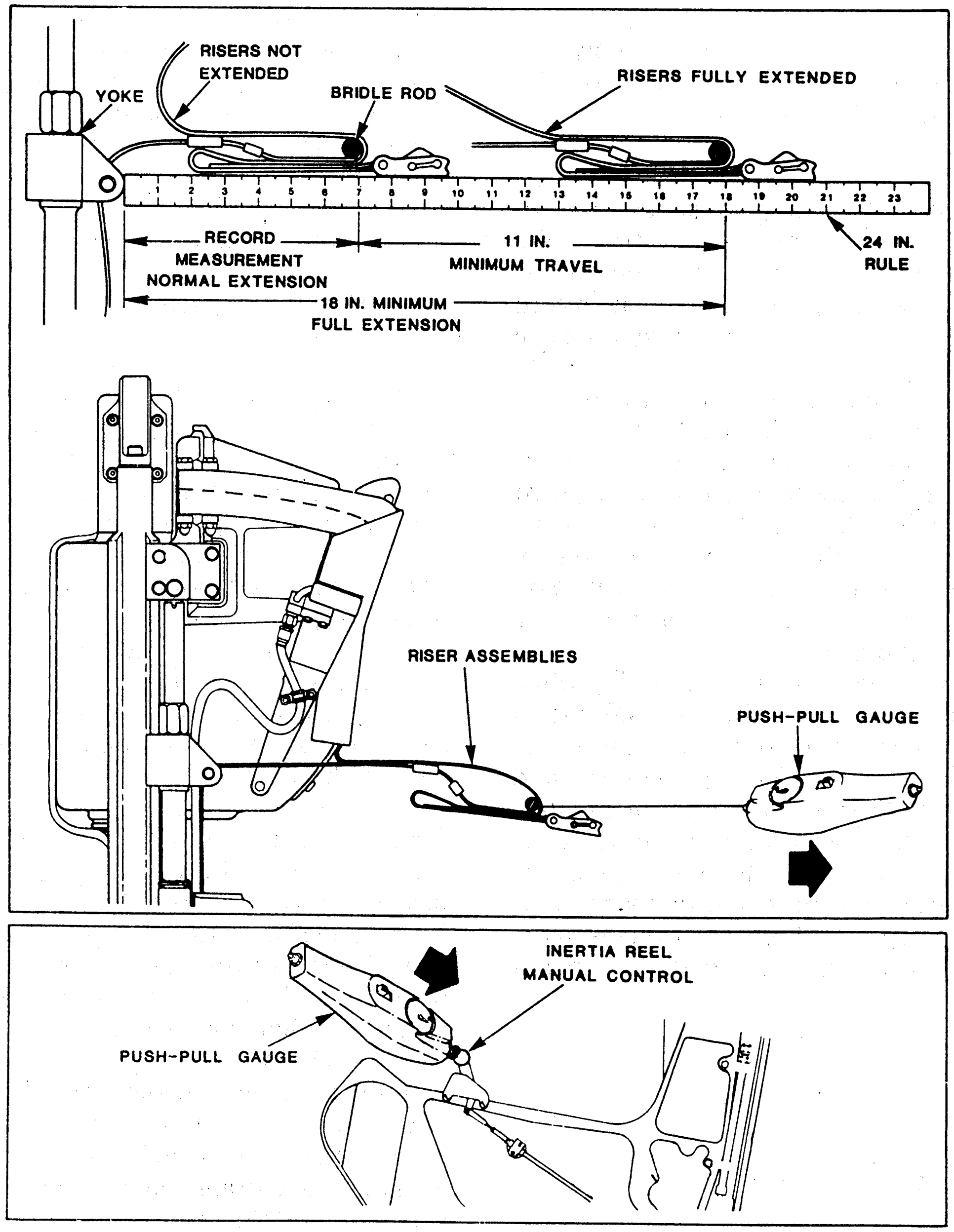


Figure 6-48.—Inertia reel assembly check-out.

measurements should be a minimum of 11 inches of total riser travel.

7. Position the inertia reel control to LOCK. Attach a spring scale to the center of the bridle rod. Position a push-pull gauge against the forward edge of the control knob parallel to the seat side panel. Apply a 50-pound pull to the bridle rod and maintain this tension while applying a push force to the control knob. The control knob should move, without binding, to the aft position with a maximum of 25 pounds of force. Allow the risers to completely retract and remove the spring scale and bridle rod.

Seat Height Adjustment Actuator Check-out

Removal of the wedge and survival kit assemblies is. not required to complete the five steps of the seat' height adjustment actuator

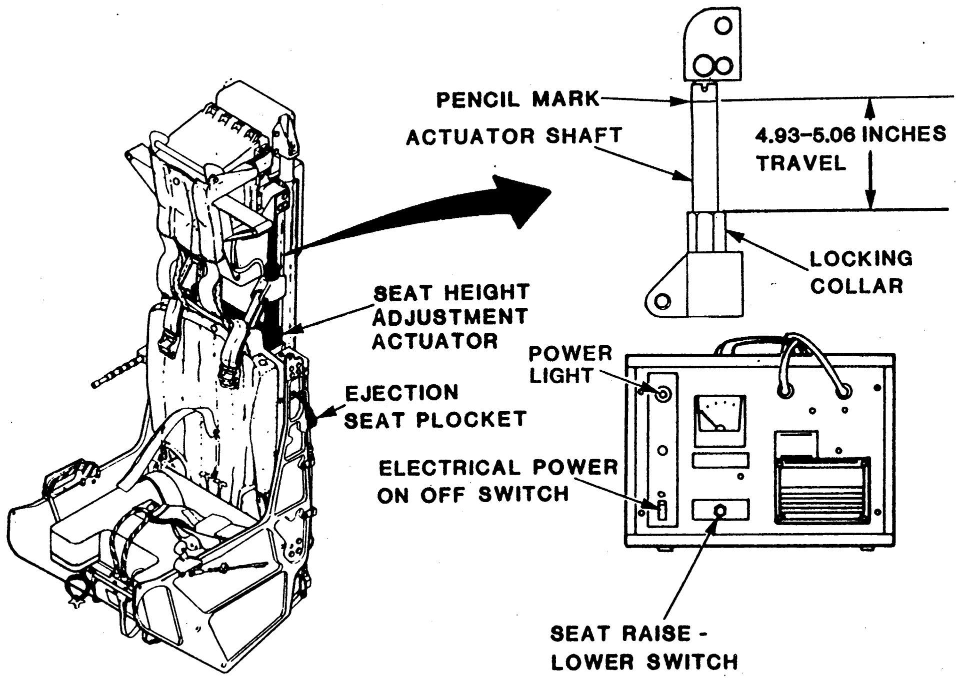


Figure 6-49.—Seat height adjustment actuator check-out.

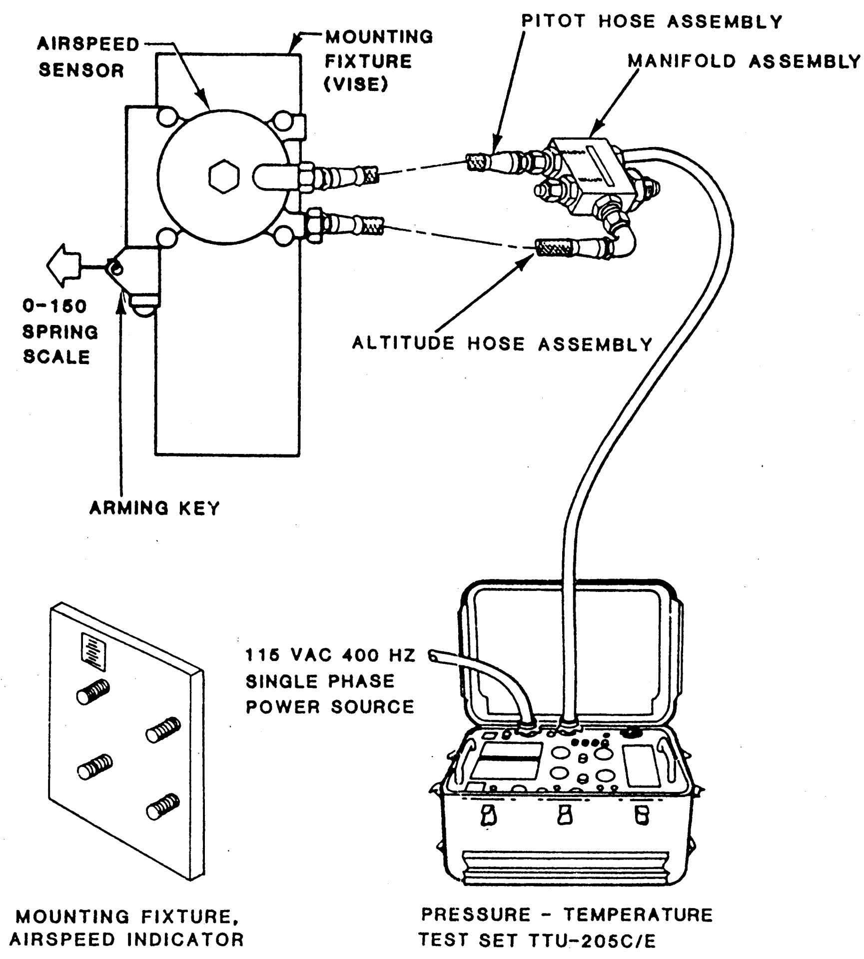


Figure 6-50.—Airspeed/altitude sensor functional check setup.

check-out. Portions of this test are shown in figure 6-49.

1. Attach a control tester to the plocket on the left side of the seat. You should ensure that the tester power switch is OFF and the raise-lower switch is in the mid position. Connect the tester electrical plug to a 115-volt ac, 60 Hz, single-phase power source and position the power switch to ON.

CAUTION

To prevent damage to the height adjustment actuator motor because of overheating, the operating time limit of 30 seconds on and 1 minute off must be observed.

2. Position the raise-lower switch to RAISE and hold it in that position. You should observe the current indicated on the control tester ammeter while the seat travels to the full UP position. The maximum start current should be 15 amps and the maximum run current should be 5 amps.

3. Release the raise-lower switch and place a pencil mark on the actuator shaft at the locking collar. Now, move the raise-lower switch to LOWER and hold it in that position. Again, you should observe the current indicated on the control tester ammeter while the seat travels to the full DOWN position. You should notice no binding while the seat is traveling. The start and run current requirements are the same as in the previous step.

4. Release the raise-lower switch. At this time, you should measure and record the distance from the pencil mark on the actuator shaft to the upper edge of the locking collar. For the test results to be acceptable, the difference between the measurements should be 4.93 to 5.06 inches of total actuator shaft travel.

5. Raise the seat bucket to the mid-travel position. Position the power switch to OFF. Disconnect the tester electrical plug from the power source and disconnect the tester electrical plocket from the seat.

Airspeed/Altitude Sensor Check-out

The airspeed/altitude sensor (A/AS) must be removed from the aircraft to perform the check-out procedure. The following paragraphs describe the steps of the test procedure. Figures 6-50 and 6-51 show portions of the test.

1. Place the A/AS in the mounting fixture and secure it to the workbench. Screw the pitot

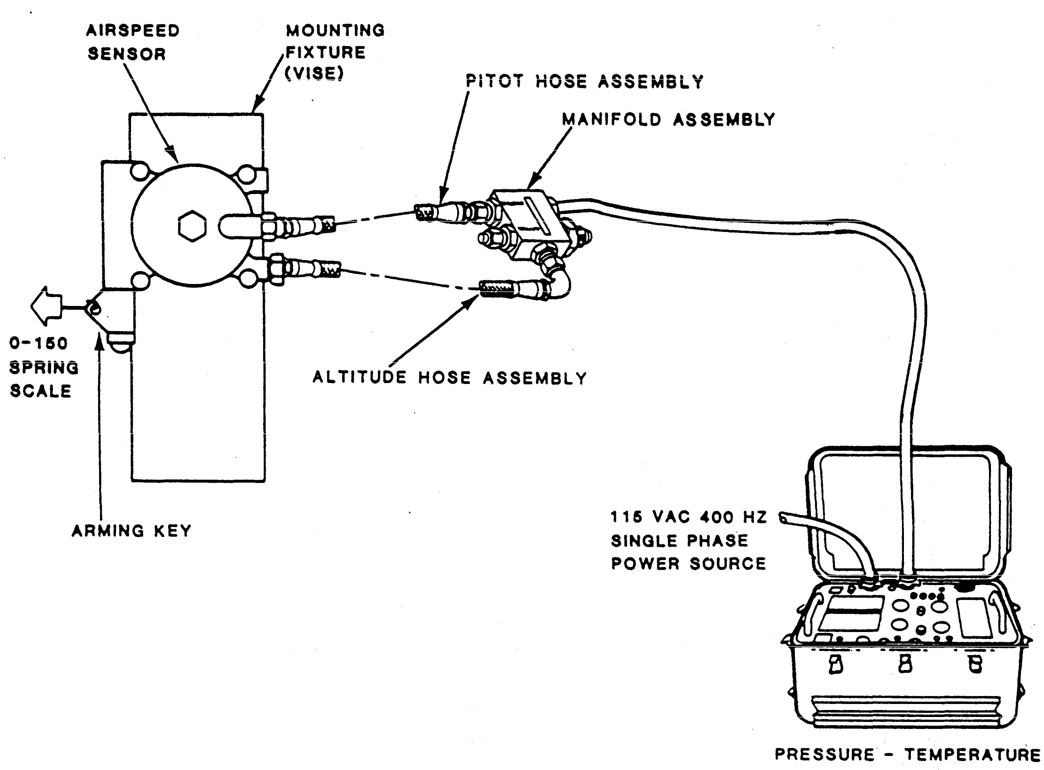


Figure 6-51.—Airspeed/altitude sensor function check.

hose from the manifold assembly onto the pressure port of the A/AS. After you remove the static port filter, screw the altitude hose from the manifold assembly into the static port of the A/AS. Then connect the pitot pressure hose of the test set to the airspeed port of the manifold assembly. Set the pressure temperature test set controls to the positions listed in table 6-1.

WARNING

The TTU-205-C/E test set must be properly grounded to prevent injury to personnel.

2. Connect the test set electrical plug to a 115-volt ac, 400 Hz, single-phase power source. Set the test set power switch to ON. When the pressure stabilizes, the static pressure ready light and the pitot pressure ready light will illuminate. Rotate the static pressure vent and pitot pressure vent controls full clockwise. Position the airspeed knots control to 500. Vary the airspeed trim control as necessary to obtain 500 on the airspeed knots indicator. It will take a few minutes for the airspeed knots indication to increase to 500.

3. Position the airspeed leak test switch to ON. Allow the pitot pressure to stabilize. At this point, you should ensure that the pitot pressure light goes out and that the leak rate is not more than 15 knots in 5 minutes. Position the airspeed leak test switch to OFF. The pitot pressure light should illuminate and the airspeed knots should return to 500. Position the airspeed knots control to 280. Vary the airspeed trim control to obtain 280 on the airspeed knots indicator.

WARNING

To prevent injury, make sure personnel are clear of the A/AS plunger during actuation.

4. Attach a 0- to 150-pound spring scale to the arming key. Apply a straight pull on the scale and remove the sensor arming key. The arming key should release between 6 to 16 pounds of force and the sensor plunger should remain extended.

5. Extend the plunger with the pull tool and reinstall the arming key. Position the airspeed knots control to 250 and vary the airspeed trim control to obtain 250 on the airspeed knots indicator. Remove the A/AS arming key and observe the A/AS plunger retract. Again, use the pull tool to extend the plunger and reinstall the arming key.

6. Position the airspeed knots control to 50. After the airspeed knots indication decreases to the set value, position the test set power switch to OFF. Rotate the static pressure vent and pitot pressure vent controls full counterclockwise. Disconnect the test set pitot hose from the manifold and test set. Remove the pitot hose assembly from the airspeed port of the manifold and connect it to the altitude port of the manifold assembly. Plug the airspeed port of the manifold.

7. Rotate the static pressure vent and pitot pressure vent controls full clockwise. Position the

Table 6-1.—TTU-205-C/E Tester Control Settings

CONTROL	SETTING
POWER	OFF
MODULATION FREQ. HZ	OFF
MODULATION AMPLITUDE	0
MACH LIMIT DISABLE/NORMAL	NORMAL
MACH LIMIT SET	1.5
ALT LEAK TEST	OFF
A/S LEAK TEST	OFF
AIRSPEED KNOTS	50
AIRSPEED RATE/KNOTS/MINUTE	0
AIRSPEED TRIM	CENTERED
ALTITUDE X 1000 FEET	0
ALTITUDE RATE X 1000 FEET/MINUTE	0
ALTITUDE TRIM	CENTERED
ALTITUDE HOLD/NORMAL	NORMAL
TOTAL TEMP: SIMULATE	50.0 OHMS
STATIS PRESSURE VENT	FULL COUNTERCLOCKWISE
PITOT PRESSURE VENT	FULL COUNTERCLOCKWISE
NORMAL/READ EXT.	NORMAL

test set power switch to ON. Position the ALTITUDE x 1000 FEET control between 7 and 8. The altitude feet indication should increase to approximately 7750. You may have to vary the altitude trim control to obtain 7750 on the altitude feet indicator. Remove the A/AS arming key. The A/AS plunger should remain extended.

8. Use the pull tool to extend the plunger and install the arming key. Set the ALTITUDE x 1000 FEET control between 6 and 7. Vary the altitude trim control to obtain 6250 on the altitude feet indicator. The arming key should release with a pull of 6 to 16 pounds of force and the A/AS plunger should retract.

9. Again, you should use the pull tool to extend the plunger and reinstall the arming key. Position the altitude control to zero. After the altitude feet indication decreases to the set value, position the test set power switch to OFF. Rotate the static pressure vent and pitot pressure vent controls full counterclockwise.

10. Remove the manifold assembly from the A/AS and disconnect it from the test set. Disconnect the static pressure hose from the test set. Disconnect the power source and remove the test set.

If the A/AS passes the functional check, you may install it on the seat. If the A/AS is faulty, you should forward it to depot-level maintenance for repair.

CORROSION CONTROL

The manufacturers of the Stencel ejection seat have stated that the seat is corrosion resistant. Therefore, on the special 40-day corrosion inspection, the SJU-8/A ejection seat has no inspection requirements. But we know that during shipboard operation, the seat will come in contact with salt spray, jet exhausts, stack gases, and various other debris. Although the seat is not addressed in the 40-day MRCs, it should be maintained in accordance with the NA 01- lA-509 and local squadron instructions. The NA 01-l A-509 states that ejection seats should have a 7-day inspection performed while at sea and a 14-day inspection when ashore.

LUBRICATING PROCEDURES

You should ensure that oils, greases, preservatives, cleaning solutions, and solvents do not enter enclosed mechanisms, cartridge chambers, and ballistic hose and tube assemblies or come in contact with cartridges or initiators. You should cap all open ports during corrosion maintenance. All lubricants must be applied sparingly, and you must exercise care to protect nylon and cotton fabrics from contamination. Indiscriminant use of paint and preservatives that dry and build up with repeated or excessive application will often result in restricted movement of parts. This can easily render affected seats useless for ejection purposes.

The following lubricants and procedures should be used on the Stencel ejection seat as stated in the NA 01- lA-509.

1. Lubricating oil, VV-L-800, should be applied to all parts that rotate, such as bell cranks, levers, pins, rollers, and similar components.
2. Grease, MIL-G-81322 or MIL-G-23827, should be applied to all parts that slide and should also be used as a corrosion preventive for all bright metal parts.
3. Apply MIL-C-85054 by brush or swab to all unpainted, nonmoving parts, such as nuts and bolts, that do not require lubrication.
4. Cleaning solvent and lubricants may be applied with brush or cloth providing adequate care is taken to prevent entry into closed mechanisms.
5. Surface contaminants such as dried lubricants, dirt, grit, or corrosion products can be removed from intricate bell cranks and levers by scrubbing with a small nylon bristle brush using P-D-680, Type II, cleaning solvent. Follow the cleaning solvent with a light coat of VV-L-800 oil to the entire component or assembly.

EMERGENCY CLEANING

The following emergency cleaning procedures should be used for cleaning ejection seats exposed to gross amounts of salt water or fire-extinguishing agents. The procedures described are normally used only to prevent further damage and will usually require further treatment at a higher level of maintenance.

WARNING

Disarm ejection seat mechanisms before cleaning. Only authorized personnel should disarm seats and perform cleaning operations.

1. Remove parachutes, drogue parachutes where applicable, and seat pans. These items

should be returned to local work centers for cleaning or replacement.

2. Remove ejection seats according to the applicable MIM.

3. Remove the CADs, rockets, and inertia reels from the seats. Cap all gas lines and ports. Then, wipe down these components with fresh water.

4. Rinse the seat thoroughly with fresh water. Continue washing while directing the water into crevices and close fitting parts until the contaminants are removed.

5. Blow as much water as possible from equipment with low pressure, clean, dry air.

6. Dry excess water deposits with a clean cloth, clean paper towels, or remnant cloths.

7. Apply the water displacing preservative MIL-C-81309, Type II, by spray or brush to critical metal surfaces and to recess areas that may not be completely dry. Water displacing preservative protects equipment during necessary inspection or inquiry, and during transfer to the repair custodian.

8. Wash all survival gear and pilot safety equipment with fresh water and dry thoroughly. You should refer to NAVAIR 13-l-6-X for detailed preservation procedures. Lubricate and control corrosion in accordance with maintenance requirements cards.

9. You should comply with all special inspection requirements before reinstallation. Reassemble ejection seats in accordance with the MIMs.

10. If necessary, send the ejection seat to the next higher level of maintenance.

11. Aircraft-mounted escape system components (mechanically activated CADs) should be wiped with fresh water, a cloth, and dried. If external contamination is suspected, these components should be removed and replaced.

CORROSION CONTROL

The existing MIMs and MRCs for most ejection seat systems do not provide sufficient or explicit instruction for corrosion control and lubrication. The *Aircraft Weapons System Cleaning and Corrosion Control Manual,* NA 01-lA-509, and COMNAVAIRPAC/COMNAVAIRLANT INSTRUCTION 4750.2 (series) contain more information on corrosion control. These publications should be on your required reading list. The *Aviation Maintenance Ratings (AMR) Fundamentals*, NAVEDTRA 10342-3, and *Aviation Maintenance Ratings (AMR) Supervisor*, NAVEDTRA 10343-A1, also contain information regarding corrosion control. If needed, commands may develop local MRCs or local maintenance instructions to help eliminate corrosion of ejection seats.

The following general information pertains to most ejection seats. Steps must be taken to prevent corrosion before it occurs. Correct procedures for repair of components and systems after corrosion has been treated must be used to ensure that corrosion does not return. The performance of the 210- and 364-day inspections, the 7-day inspections while at sea, and the 14-day inspections while ashore should be conducted according to the applicable MIMs and MRCs. Preventive maintenance on seat components, including procedures for cleaning and lubrication, is discussed in the following paragraphs.

Seat Structure and Components

Command philosophy varies regarding the painted parts of a seat structure. Some squadrons strip and paint at each 210- and 364-day inspection. Some leave the original anodized finish unpainted. Some touch-up chipped paint. Some do nothing. Each of these philosophies has some merit depending upon local conditions. The seat bucket and beam structure should be wiped with VV-L-800 general-purpose oil. You should allow the oil to soak into crevices, around rivets, and then wipe dry.

Clean metal components with P-D-680, Type II, dry-cleaning solvent, and then inspect them for surface damage and corrosion. Do not attempt to remove light corrosion or discoloration of the cadmium-plated parts. Parts showing rust or pitting of the base metal or more than one area of plating loss should be replaced. Remove light corrosion, except for cadmium plated parts, by using a fine Scotchbrite abrasive mat or 500/600 aluminum oxide abrasive cloth. Lubricate moving parts, such as springs, linkage, and pivot areas, with MIL-G-81322 general-purpose grease. Lubricate firing pins and rollers with VV-L-800 oil. When using VV-L-800 oil, you should apply it with a clean, lint-free cloth such as MIL-C-85043.

Indiscriminate use of paint, preservatives, or other materials that dry and buildup following application can prevent or restrict proper motion of movable parts. These materials must only be used where specified on nonmoving parts. Paint touch-ups of seats installed on the aircraft should be done with a brush.

Metal Removal

The following paragraphs provide guidelines for removal of corrosion products without damaging the structure. Removal of corrosion that has propagated beyond these limits requires replacement of the part.

CADMIUM-PLATED PARTS.— On cadmium-plated parts, corrosion will be evident as mottling of the plated surface with color ranging from light gray to black. This is a function of the cadmium plating to protect the underlying base metal, and no attempt should be made to remove the discoloration. The presence of exposed base metal in a localized area is acceptable and should be protected. The appearance of red rust is cause for part replacement.

CHROMIUM AND NICKEL-PLATED PARTS.— You should polish bright plated parts with a fine Scotchbrite abrasive mat or 500/600 aluminum oxide abrasive cloth. Do not penetrate to the base material. If base material is exposed, it is cause to remove and replace the affected part.

ALUMINUM FORGINGS AND CASTINGS.— Metal removal should not exceed 0.005 inch in depth. You should apply chemical conversion coating (alodine) to bare surfaces and repaint them as required.

RESTORATION OF FINISH

Abrasions and isolated damage areas may be restored using the following procedures: First, mask the area to be treated. You should feather sand the area around the damage with abrasive paper or Scotchbrite mat. Next, apply paint remover or methyl ethyl ketone and wipe the area dry with cheesecloth before the solvent evaporates. At this point, if bare metal is showing, you should apply alodine and allow it to dry. Finally, apply one coat of primer and two coats of paint.

Special attention should be paid to the use of primers, polyurethane paints, paint removers, and methyl ethyl ketone. They are all flammable and toxic. Do not use them near open flames or sparks. Do not allow them to come in contact with your skin or eyes. Their use should be restricted to a well-ventilated area.

SAFETY PRECAUTIONS

Safety precautions must be strictly observed when working around aircraft equipped with an ejection seat. These safety precautions cannot be overemphasized. Each ejection seat has several ground safety pins. These safety pins are provided on red-flagged lanyards for use at every point of potential danger. They must be installed whenever the aircraft is on the ground or deck, and they must never be removed until the aircraft is ready for flight.

The following general precautions should always be kept in mind:

1. Ejection seats must be treated with the same respect as a loaded gun.
2. Always consider an ejection seat system as loaded and armed.
3. Before you enter a cockpit, know where the ejection seat safety pins are located and make certain of their installation.
4. Only authorized personnel may work on, remove, or install ejection seats and components, and only in authorized areas.

Supervisors take note. It has been said that nothing is foolproof because fools are so ingenious. Personal safety for those who work around ejection seats cannot be guaranteed; however, a high level of safety can be achieved if personnel have the proper attitude, understanding training, and adequate supervision. Unless proper maintenance procedures are followed explicitly, even the most routine ejection seat maintenance tasks can grow drastically out of proportion and bring about an accident or injury. Education of the workers involved is the best assurance for personnel safety. The workers should be made aware of potential hazards and the proper means of protecting themselves. Workers should be assigned according to their capabilities.